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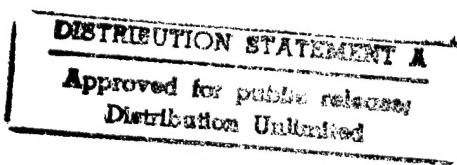
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China Report

SCIENCE AND TECHNOLOGY

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18 JULY 1986

CHINA REPORT
SCIENCE AND TECHNOLOGY

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NATIONAL DEVELOPMENTS

1985 TECHNOLOGY MARKET STATISTICS REPORTED

Tianjin JISHU SHICHANG BAO in Chinese 11 Mar 86 p 1

[Text] According to statistics and figures announced recently by the State Science and Technology Commission 1985 was a year of abrupt development for China's technology markets. Statistics from 36 provinces, autonomous regions, directly administered municipalities, and individual cities, and from 34 ministries affiliated with the State Council show that there were 34,740 technology negotiation projects (among which were 17,600 contracts), negotiated funds totalled 10,867,520,000 yuan (contracted amounts among which were 4,730,290,000 yuan), 17,103 projects were locally affiliated for 49.23 percent of negotiation projects, and negotiated amounts were 398.42245 billion yuan, which was 36.66 percent of the total; 17,637 projects were affiliated with departments, which was 50.77 percent, and negotiated amounts were worth 6,883,290,200 yuan, which was 63.34 percent. Because last year the banks were retrenching and bank loans were difficult, by the end of last year, the total number of projects implemented by local areas and departments were 9,932 (8,128 of which were contracted), which was 28.60 percent of the total negotiated. Total value of deals transacted was 2,303,951,600 yuan (among which 2,018,954,300 yuan was contracted), which was 21.20 percent of the negotiated amounts (the proportion of contracts implemented was 42.68 percent). Looking at things from our current viewpoint, business activities in the technology markets are largely undertaken between science research organizations on the one hand and small to medium enterprises and township and town enterprises on the other. The value of transactions in these areas was more than 60 percent of the value of transactions at the first national technology achievements trade fair.

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S&T AWARDS FROM 6TH 5-YEAR PLAN REPORTED

Tianjin JISHU SHICHANG BAO in Chinese 11 Mar 86 p 1

[Text] During the period of the "Sixth 5-Year Plan," our Party and government adopted many major measures for protecting, encouraging, and disseminating scientific and technical achievements, which were quite effective. According to the most recent statistics from 40 departments from 29 provinces, autonomous regions, directly administered municipalities, and the State Council, there were 34,045 major achievements recommended to the state during the period of the "Sixth 5-Year Plan"; 44,540 scientific and technical achievements were awarded national and provincial level prizes.

The situation regarding awards for scientific and technical achievements, based on statistics of 18 departments from 23 provinces, cities, autonomous regions, and the State Council, was that among the 98,245 scientific and technical achievements, 91,930 were technical achievements, 93.6 percent of the total; there were 6,315 theoretical achievements, for 6.4 percent. Among these scientific and technical achievements, 5,247 were of an international standard, 3,336 were part of national planning, 31,450 were completed by independent science research units, and 35,220 were of a general level. With the full scale development of the restructuring of the science and technology system, science and technology in this country are catering to economic construction. During the period of the "Sixth 5-Year Plan," 2,834 won national awards, which included 937 winning national prizes for invention, 125 won national awards for the natural sciences, and 1,772 were judged for the first time for national science and technology prizes. Economic results after application of these prize winning inventions have, in all, increased income or savings of about 30 billion yuan, 32 projects among which accounted for more than 100 million yuan for a total value of 26.612 billion yuan. According to preliminary statistics, projects completed during the "Sixth 5-Year Plan" had total gains in income or savings of about 76.5 billion yuan. Thirty-two first prize or higher projects among which totalled 24.6 billion yuan.

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LU JIAXI EXPLAINS 7TH 5-YEAR PLAN S&T GOALS

Beijing RENMIN RIBAO in Chinese 7 Apr 86 p 1

[Report by Chen Yun [7115 5366]: "Conditions Exist in This Country Such That We Can Make Great Accomplishments in Fields of High Technology"]

[Text] Lu Jiaxi [4151 0857 6932], National People's Political Consultative Conference (CPPCC) committee member and president of the Chinese Academy of Sciences, has said that the mission proposed for China's science and technology circles by the "Seventh 5-Year Plan" draft plan is a formidable one, but as long as we strive to work together and to do our work well, then it is something we can realize.

According to requirements of the draft plan, during the period of the "Seventh 5-Year Plan," we will strive for great achievements in research and development in the fields of new technologies and high technologies. At the Fourth session of the Sixth National CPPCC when Lu Jiaxi spoke to reporters about this mission, he said that the key to China developing high technology is in organizing and concentrating our strength in solving problems, in breaking up the old system of departmentalization and control by professions, in implementing lateral relations, and in enhancing coordination. He said that although when comparing our conditions with those of advanced countries there are significant gaps, these are in regard to the overall levels of science and technology, and actually in many respects current standards approach or attain advanced international standards. He said that we can neither be blindly arrogant in scientific and technical areas, nor should we belittle ourselves.

Committee member Lu Jiaxi went on to analyze the advantageous situation in China for developing science and technology. He said that in terms of personnel, there are several older scientists who are world recognized authorities; the abilities and enthusiasm of large numbers of young and middle aged scientists and technicians are not less than those of the same generation in similar professions throughout the world, but through what has been accumulated since the founding of the nation, and especially advances in recent years, we now have a great deal of advanced equipment; and although financially we are currently rather strapped, the state has determined that during the "Seventh 5-Year Plan" we will increase funding in these areas. With these people, finances, and materials, although we will not be entirely

well off, with great effort, we can do many things in the fields of science and technology.

Lu Jiaxi said that our nation has had some successes in developing high technology. During the 1950's, the nation determined to unify and coordinate its strength, and in the 1960's we then exploded the atomic and hydrogen bombs, and our satellites were sent up. These are examples that serve well to explain problems.

Regarding the principles of new technology research, committee member Lu Jiaxi stressed that first of all we must follow in the footsteps of advanced world technologies, and then we must strengthen basic research and innovative science and technology, as well as keep core science research contingents together. He said that our strength in science research has always been departmentalized and dispersed, with personnel often leaving. The state has now noticed these problems, and is in the process of solving them in terms of policies, which will give us the conditions under which to accomplish the mission assigned by the "Seventh 5-Year Plan" to develop new technologies and high technologies.

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REGULATIONS ON ALLOCATION OF S&T PROFITS REPORTED

Tianjin JISHU SHICHANG BAO in Chinese 11 Mar 86 p 1

[Text] Recently, on the basis of former provisions and also on actual conditions, the Shanghai Municipality Tax Bureau and the Bureau of Finance has made new provisions regarding allocation methods for income from the "Four Technologies" (transfer of the rights to technologies, technical service, technical consulting, and technical training), the substance of which is as follows:

First, beginning 1 January 1986, there will be a 3 percent operations tax figured against the totals for scientific and technical achievements from publicly owned enterprise units in Shanghai and for the gross income from sales of technology, technical service, technical consulting, and technical training. Regarding net profit after costs, where annual totals are less than 300,000 yuan (including 300,000), tax is deferred, the total sum to be retained by the enterprise; for portions that exceed 300,000 yuan, enterprises will pay the tax as regulated. For sales to Yunnan, Ningxia, Xizang, and Xinjiang, which the state has assigned for support to Shanghai, the entire amount of annual income below 400,000 yuan (including 400,000) may be retained by the enterprise, the tax to be paid by the enterprise on the portion that exceeds 400,000 yuan.

Second, the principles for disposition of net income retained by enterprises are:

1. where annual totals are 10 percent or less of the enterprise reserve funds, usage will be proportioned as follows: 30 percent for production development funds, 20 percent for staff and worker benefit funds, and 50 percent for staff and worker awards and bonuses.

2. where annual totals are more than 10 percent of the enterprise reserve funds but less than 20 percent, that portion exceeding 10 percent will be proportioned as follows: 35 percent for production development funds, 20 percent for staff and worker benefit funds, and 45 percent for staff and worker awards and bonuses.

3. where annual totals are more than 20 percent of the enterprise reserve funds, that portion in excess of 20 percent will be proportioned as follows: 50 percent for production development funds, 20 percent for staff and worker benefit funds, and 30 percent for staff and worker awards and bonuses.

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STATE S&T COMMISSION MEMBER DISCUSSES PERSONNEL PROBLEMS

Beijing RENMIN RIBAO in Chinese 10 April 86 p 5

[Article by Guo Shuyan [6753 2885 6056], vice minister of the State Science and Technology Commission: "Three Problems in the Management of Scientific and Technical Personnel"]

[Text] Problems Regarding Implementation of the Hiring System

Realizing a hiring system for intellectual laborers is quite a common thing throughout the world, but in China we have in the past maintained a unified allocation by organization. Such a system cannot meet the needs of scientific and technical development today. We should begin to implement a hiring system in areas where intellectuals are more concentrated. In April of last year the experiences of 60 units in implementing a hiring system were shared in Shanghai by the State Science and Technology Commission. The results of the implementation showed that: 1. this aided the selection of the worthy and employment of the capable and also avoided occurrences of the types of problems where particular units attacked intellectuals and harmed them, and it was beneficial as well in making the most of intellectuals and for the maturing of talent. 2. There is a certain autonomy for units and individuals in seeking personnel, in responding to such searches, and in leaving positions, which has broken up "unit ownership" and has been of use to the transformation of negative factors. 3. It has promoted the rational movement of personnel. It primarily invigorated units internally, and at the same time accelerated the rational movement of personnel between regions, departments, and professions.

At present, the main problem in realizing the hiring system has been what to do after quitting a job? In China, we have not yet perfected our social insurance and labor insurance systems, and if the contradictions are extended into society, that will not be of advantage to the security and unity of society. Even though the state has planned to explore the possibilities of social insurance during the period of the "Seventh 5-Year Plan," units must still actively help those who want to quit arrange for appropriate work, or allow for further study to create the conditions in which to find employment. But for those people who do not work responsibly, who have not responded to employment opportunities, but who do not accept unit arrangements, then organizational measures must be adopted and their wages must be reduced.

There Should Be Rational Movement of Personnel

Leading comrades of the Central Committee have pointed out: "Advocating personnel movements is a correct direction." In 1983 the State Council drew up a document encouraging the rational movement of personnel. However, the situation for the rational movement of personnel has not been truly opened up. Personnel must be moved rationally, but this is not a free movement. The cities cannot go to the countryside to find talent, and at the same time, large enterprises cannot look for talent in small enterprises, nor can inland areas go to the borders. We want to change the way in which we are employed for life, which will allow personnel to move rationally. To stabilize scientific and technical contingents in frontier and hardship areas, from now on we will progressively implement the method of fixed working periods and dynamically seek the overall stabilization of scientific and technical contingents. For example, in Xizang we are using a policy of 8-year work periods where after expiration the worker can return to his original job. In the future, we plan to work out particular working periods and preferential policies for more than 600 counties and banners at the frontiers and in hardship areas. In movements of personnel, we are opposed to departures without resignation, which is behavior that is unorganized and without discipline. Within the same city or region, it should be encouraged that units with accumulations of personnel adopt various means by which to allocate excess strength to units deficient in personnel. As it has been determined by Shenyang, where a group of technical personnel have been selected from some large units in that area to take on the jobs of factory directors or senior engineers at local enterprises, their wages being paid by the employing unit with the former unit retaining their authorized strength. This method has allowed a group of small to medium enterprises a chance at better circumstances, and as a result, a large portion of the scientists and technicians sent to the local enterprises have elected to stay in order to change conditions at the enterprises and to continue their efforts. The great majority of them have become key members of these enterprises.

Scientists and Technicians May Hold Concurrent Jobs

Why should we encourage scientists and technicians to hold concurrent jobs? Primarily, this is to better train personnel and to make better use of them. From an overall point of view, there are benefits to mathematics, science research, and to economic development, and there are advantages as well for intensifying relations between science and technology and production, for opening channels of information, and for developing individual strengths.

What is currently most sensitive is the problem of holding a second job in one's sparetime. Scientists and technicians use their spare time to engage in development and in technical service and they retain such income as it is earned. This was proposed last year by the State Council upon studying the problem of compensated transfers of technology. Under conditions that guarantee finishing work at the primary job, that scientists and technicians should appropriately engage in concurrent labor during their spare time is a good thing that can benefit the state and benefit the people, and we ought to support it. The policy limits ensure the completion of work at the primary

job and that there is no violation of the technical and economic rights of the primary unit. If we can achieve these two conditions, then leadership at all levels ought to make this possible, and consequently should change the situation of the past in which people were unwilling to be open about sparetine jobs. Naturally, what we primarily advocated regarding this question of concurrent employment was organized, guided concurrent employment. Spare time employment should first of all be reported to the leadership. There is at present an unreasonable phenomenon, namely that where there is little labor in sparetine, the benefits from it are very great; where primary work is quite arduous, the benefits are limited. This situation is not conducive to motivating staff and workers in earnest execution of their jobs. Therefore, we should study and formulate necessary restricting measures to appropriately limit the income from sparetine work. As reform of the wage system and income tax proceeds, this problem will be gradually resolved.

To take good care of the reform management of the entire science and technology contingent, to create a policy environment that can allow each scientist and technician to fully develop his own abilities and to make more contributions to society, these are both the points of departure and starting points for our reform of the personnel management system.

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DU RUNSHENG DISCUSSES ROLE OF S&T IN RURAL POLICY

Beijing RENMIN RIBAO in Chinese 11 Apr 86 p 5

[Article by Du Runsheng [2629 3387 3932] derived from a speech given to the National and Local Science and Technology Work Experience Exchange Conference held jointly by the State Science and Technology Commission and the China Science and Technology Association; originally published in ZHONGGUO KEJI BAO: "Rely Upon Science and Technology to Strengthen the Economic Position of Agriculture"]

[Text] This year's Document No 1 from the Central Committee emphasized that we will pay close attention to the technical transformation of the countryside and rely upon science and technology to increase rural output and farmer's income. Why go so far to emphasize this direction? Because economic development of the countryside from now on will be more and more restricted by relative shortages in resources. Absolute quantities of natural resources in this country stand among the highest in the world. But our population is too great and our per capita share of those resources is far lower than the world average. One billion want to eat and wear clothes, 800 million farmers want to raise their standard of living, so this small per capita share of natural resources is obviously quite deficient.

Naturally, this idea of "quite deficient" has no absolute standard of measurement. With improvements in the ways resources are used, that deficiency can be supplemented, even to the extent that the deficiency becomes an abundance. By progressively strengthening the financial support of agriculture and by relying on scientific and technical advances to improve the utilization rate of resources in rural production, the difficulties of relative insufficiencies in natural resources can be overcome, and new prospects can be envisioned. Many nations that have already modernized their agriculture have taken these steps, so we cannot only do so ourselves, but can do so well. The key will be in earnestly recognizing the function of scientific and technical advances in accelerating rural economic development. The goal of the reforms we are currently undertaking is to bring new vitality to the economic system, but if we lack the material conditions and there are no scientific and technical advances, we will not be able to maintain acceleration of economic development for any length of time just by relying on this vitality. Reform of the economic system must go on and the propelling role of science and technology for rural economic development should be enhanced, which is the primary spirit of this year's Document No 1.

Adapting to Commercial Production Requires Dissemination of Scientific and Technical Achievements

From the point of view of the history of world economic development, and particularly of regions, advanced science and technology will always bring great benefits to economically developed regions, only after which can they be shifted to backward regions. As far as industrial categories are concerned, the benefits to industrial departments greatly exceed those to agricultural departments. Agriculture was born several thousand years ago, and there was rural civilization before that of cities. Industry only began to propel the development of urban civilization some 300 years ago, and there is a great gap between the two.

The progress of history has shown that the popularization of advanced technology is closely related to development of a commercial economy. Science is transformed into technology, and technology is transformed into production forces, these are shifted from developed regions to undeveloped regions, from developed sectors to undeveloped sectors, and are progressively advanced with the development of a commercial economy. In high-gain sectors and enterprises with large accumulations there are greater possibilities for the use of advanced technology, while on the contrary sectors and enterprises with few gains or accumulations have greater difficulties using advanced technology. And then, because they cannot use the advanced technology, profits will be reduced, accumulations will decrease, and this will lead to a vicious cycle. The backwardness of rural science and technology reflects just this sort of situation.

Benefits to advanced regions are great, as are those to advanced sectors. This is a fact that cannot be changed by good intentions. However, should it be that backwardness should always be backwardness, or that the advanced should always be the advanced, forever fixed and unchanging? That is not true, either. Science and technology will always shift from advanced regions toward backward ones, which is a requirement of commercial economic development. When beneficial relations change, science and technology will always seek out new regions with vitality in which to develop, and formerly backward regions just happen to give them this opportunity. The United States took over the foremost position in science and technology from certain European countries, and after the Second World War, the economy of Japan flourished. Some countries and regions that have developed to a middle grade of development or that have made remarkable progress in certain fields of production, are all examples of science and technology shifting from advanced regions to backward ones. From this we can derive two rules: one is that the development of science and technology depends upon an economic foundation, so that the more developed an area is the quicker will be the development; the second is that advanced technology will shift from developed areas to undeveloped areas, and will shift from advanced industries to backward industries.

From this first rule we can see the fundamental conditions for the development of science and technology. However, if we look only at these conditions and consider it as nothing attempted and nothing gained, then that would not be

Marxism but fatalism. We must look also at the second rule and use it to promote the economic development of undeveloped regions, especially to promote agricultural development, because it depends upon the labor with which to make a living and involves the most people, and it is a very undeveloped industry economically.

Appropriately Select Points of Focus and Regard Actual Results Highly

In hastening the shift of science and technology to the countryside, it is not important whether tasking is plentiful, nor how good aspirations are, for what is important is a thorough understanding: from the operation of which production links and economic projects will results be best, and which can as well constitute a driving force for agricultural production, and which technologies are both relatively advanced and can yet suit economic and social conditions of a particular time and place. Having chosen the important links, then be unremitting, pay close attention, strive for practical results, and avoid ineffective work.

From the point of view of current conditions in the countryside, we can select from various angles:

First, raw materials and products. Products such as cotton, flax, silk, sugar, fruit, etc., are still in relatively favorable positions as far as price is concerned, market needs are also quite exuberant, the light industries need them, the textile sector cannot do without them, so the state must direct a certain amount of financial resources to support their production. These kinds of products are in urgent need of advanced technology, which is quite worthy of our attention.

Second, agricultural products are best at earning foreign exchange. There are forty major types, and for minor types each area has its own specialties, and we want to develop the strengths of each in their particular products.

Third, township and town enterprises. This is the sector in the countryside where the most gains are to be made and which urgently needs expanded production and improved quality to maintain their advantages within competition. Town and township enterprises are group economies that assume sole responsibilities for profit or loss, and with the impulse of technical advances will themselves engage in the search for gain. The "spark plans" that have been organized by the State Science and Technology Commission for implementation are exactly to cope with the outcome of these needs and are certain to bring about great results. This is the growing point for rural economic development, and is certain to be successful.

Fourth, various intensive operations units in the countryside. There have already been indications along the southeast coast and in large cities and suburbs that the first steps have been taken along the path of commodity production development. There will appear in the future highly social production combinations formed from the integration of many specialist households--rural enterprises of an appropriate scale. Production organizations that possess relatively high fixed asset accumulations are just the media through which to attract new technologies. For example, cultivation

operation large households planting 30 or 40 mu will appear in the future along the southeast coast, and many of these operations households could appear in a given natural village. They will not primarily rely upon increasing labor to develop production, but will depend upon the introduction of various machinery and fertilizer, and will depend upon the introduction of new technology to improve economic results. The level of their fixed asset accumulations will improve annually, and the introduction of human labor will decline. This will then signify primary reliance upon technical advances to develop production. The four aspects just discussed are some directions in which we have choices, and they are also points of entrance for advanced technologies into the countryside. Naturally, there are also problems to be fully considered, such as using technology to support impoverished areas, where it is not that we will ignore all else, but that it is necessary to select points of focus.

Fifth, those things that are low in cost but high in profit. Production technologies themselves have production costs, and their dissemination must also consider costs. The lowest costs in modern agriculture are in improved varieties, which improve production forces through the improvement of biological properties. For various improved varieties, including good livestock, the money spent for raising them is not considered excessive and farmers more easily accept it. We have a socialist system, and where the state has assumed the majority of costs for breeding, the costs for using the results are low, so to develop an improved variety will bring excellent economic results. We have a long history of work in the selection and cultivation of improved varieties, the types of crops have been abundant, and control of modern cultivation technologies has also been rapid. There can be no limits to the development of these advantages and in keeping to our work in improving varieties.

Depend on Science and Technology, Improve Relative Benefits of Agriculture

The trend toward a constant decline in marginal profits for agriculture is nearly a world-wide phenomenon. Similarly, the results of one yuan investment in agriculture cannot compare with that in industry, nor is the labor of one person in agriculture comparable with that of one in industry. For those reasons farmers are always thinking, "I must get away from the farm!", they do not consider increasing their investment in the land. Last year, in certain regions there were instances of lower interest in planting improved varieties. Farmers are unwilling to invest money in the land, and are not only unwilling to buy fertilizer, but in some areas organic fertilizer is not even being used. Some are even unwilling to raise pigs. There is an economic rule here: when income level reaches a certain level, laborers will choose to operate in search of opportunities for earning money, and they will even so choose between labor and rest. In making choices regarding production investments, that laborers should have so many possibilities is a phenomenon of progress in society, and serves to explain why our economic standards over the past few years have actually risen so quickly.

At present, grain crops show the least benefits in the countryside. Grain is a necessary product for life, the use value of which is obvious, and when the exchange value is not so high it becomes a commodity of great contradictions.

Great quantities of it are consumed and it is involved in the national economy and the people's livelihood, so prices cannot be too high. To stabilize a basic living standard, there is no government that has not come forward to control grain production and to implement policies of protection. On the one hand, this guarantees that farmers will take in an income from growing grain that is greater than costs and that supports profits for producers; on the other hand, by having grain price supports and by storing grain, this prevents the consumer from being adversely affected by pressure from rising prices. China cannot be an exception to this. We support 0.10 yuan on each jin of grain. When the price at which farmers sell grain is high, that is "selling expensively," and when urban residents buy grain at a low price, that is "buying cheaply," and when buying and selling prices are reversed, the state will supplement. Doing things this way, in comparison with doing other things, the planting of grain cannot be planned for. When one mu of land can produce 1,500 jin of grain per year, that is a high standard, but at 0.20 yuan per jin, that is still only 300 yuan, and not counting the labor that has been involved but taking off other investment, the net income is only about 180 yuan. The total number of days spent in labor over two seasons is 100, so that is 1.80 yuan a day, and in many areas no matter what people do they can make more than this. If we figure on a basis of an average price of 0.15 yuan, even those figures cannot be met. When prices were raised in 1979, the farmers were happy. But now other things have gone up in price, costs are higher, and relative profits have declined. But can we again raise the price of grain? A rise in grain prices will lead in turn to a rise in other prices, which will generate problems in satisfaction with income levels and social dissatisfaction. If we follow up by increasing financial supports to raise grain prices, that will be difficult for the state to accept. It would appear that for the most part we must depend upon advanced science and technology. Within a certain period, use money in the areas of science and technology and in building up basic equipment. This will be the most use to developing agricultural production. We will work hard at achieving a universal improvement in the level of technology in the countryside, and when there are even greater breakthroughs in production technologies for certain agricultural commodities, this will bring greater competitive capacity to these products on the international market. It will change low income agriculture into high income agriculture, and will change the agriculture of low profit levels to agriculture of higher profit levels. Another thing we want to do is to extend the production process for agricultural commodities, bring in advanced technology, undertake rough processing, intensive processing, and comprehensive utilization, and to shift agricultural labor to the process of raising value through processing. In this way, surplus rural labor can be changed into an economic advantage, resources will have new methods of utilization, and the income of farmers can greatly increase. In the United States there are only 2 million people planting crops and cultivating, but 20 million are involved in labor for service and processing before and after production. If we can progressively develop these sectors in the countryside, we can solve a large proportion of the problems that are now appearing.

Work According to Natural Rules, and Work According to Economic Rules

In comparing agriculture and industry, the most important characteristics are that their natural production processes are effected both by natural restrictions and by economic conditions, for which we assume a "dual risk."

Agriculture in this country retains a very large empirical component, and the level of technology in many areas is not all that different from a thousand years ago. A family or household simply cannot overcome the hazards of nature, and without advanced technology and plentiful fundamental facilities, it is impossible to hold back natural disasters. In the process of agricultural production, funds and labor are relatively idle for long periods of time, and if this is not handled well it can cost money. When putting land into production to a certain degree, if technology is not advanced, then there will be a consequent progressive decrease, and the more put into production the less worthwhile it is. In industry, the skies and the earth can be dealt with, and there are fewer difficulties in this area.

We have put a lot of effort into controlling salinization, and there have been results in a small number of areas, but the majority of areas have still not changed their outlook. We have agreed that control of large areas is not economically feasible at this time. Whether we can change tactics and think of ways to seek out crops more suitable to these harsh environments, that will allow the useable land area within our 9.6 million sq km national territory to be expanded somewhat. There is a basis in the natural world for success here, for beaches have long had plants that tolerate salinity. Plants in the desert are very drought resistant, and there are penguins and krill in the extremely cold Antarctic that can survive and multiply, which shows that there are many forms of life that can generate changes to adapt to an environment. Modern science and technology, and especially with the development of genetic engineering, have already provided possibilities for using the various adaptabilities of life forms. By enhancing studies in these areas, we can certainly break through the limits of nature.

In this country, we currently divide arable land into the three classes of high, medium, and low, where two-thirds of that land is either medium or low. Low production fields are very difficult to transform into high production fields. How we are to find a better planting program is an important topic. In the past, we did not trust the traditional experience of farmers, and we did not believe in the choices farmers made in decision making, and we made a mess of things by giving the wrong orders. However, the experience of farmers also has its limits, for it is the experience of small producers; if, within a larger context, we are to arrange cultivation by making use of the environment and adapting to the environment, then we must rely upon modern science and technology, and cannot depend solely upon the experience of farmers. For example, to seek a better planting program on existing arable land with the existing level of technology, we can use computers to analyze and compare, and to calculate the reflected prices from various basic production factors, and through optimal design to point out possible choices in various programs. This kind of modern decision making method will transcend the traditional methods of farmers.

To put modern science and technology into operation in the countryside, and to progressively eliminate the technology gap between cities and villages, will without doubt be the major historical mission of science and technology leadership structures and the vast numbers of scientists and technicians. For things that farmers cannot conceive of or that they cannot accomplish, support will be sought from scientific and technical circles to help them come up with ideas and to help them accomplish things. For these reasons, comrades who are engaged in science and technology, who are engaged in the dissemination of technology, should better understand economic and social conditions, and in addition to knowledge of technology, should have a head for economics. There are broad fields of applications for science and technology in the countryside, one very important area for which is in improving the utilization efficiency for natural resources, and in seeking out various good ways in which to conserve and replace constantly depleting natural resources. This is not only a technical question, but is an economic question, and only by obtaining economic results above a certain level can advanced technology be accepted by society.

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NATIONAL DEVELOPMENTS

OPPOSITION TO SPARETIME S&T EMPLOYMENT DISCUSSED

Beijing RENMIN RIBAO in Chinese 9 Apr 86 p 3

[Report by Xiao Guangen [5135 7070 2704]: "We Cannot Be Too Restrictive of Spare Time Jobs for Scientists and Technicians"]

[Text] Since the last part of February this year, nearly every day units have sent people to the Shanghai Science and Technology Association Service Center for consultations: which scientists and technicians have joined in consulting service? How much money have they made? Reporters have overheard scientists and technicians discussing this a lot in factories and enterprises, in science research units, and in the higher institutions: current restrictions on spare time work are too numerous and too strict, they are of no use in motivating the enthusiasm of scientists and technicians, nor is this any good for the state. Everyone is hoping that leading departments can perfect their policies toward sparetime work as quickly as possibly.

Scientific and technical consulting is a new occupation that has sprung up abruptly during the reforms. Under the prerequisite that they first finish their primary work and that they not violate the rights of the host unit, scientists and technicians have made use of their sparetime to take part in scientific and technical consulting, which is good for the state, the group, and the individual. The various consulting organizations in Shanghai already constitute an important channel for developing lateral economic relations, and have solved many technical difficulties for various regions, and have generated excellent social and economic results. Based on a sampling survey, 40 yuan in profit is generated on the average from each yuan of consulting fees, while for each yuan of compensation received by scientists and technicians involved in consulting, from 200 to 400 yuan in profit is created for society.

The resolution by the CPC Central Committee regarding restructuring of the science and technology system clearly provides that: "Under the prerequisite that they complete their primary work and do not violate the technical and economic rights of their host unit, scientists and technicians may engage in technical work and consulting services in their sparetime, the income from which will remain with them." The "Circular Regarding the Limits of Policy in Ensuring the Smooth Progression of the Science and Technology System Reforms" issued by the State Science and Technology Commission in 1985 also pointed out

that "With the clear distinction that such activity is under the prerequisite of completing primary work and that there is no violation of the technical rights of the host unit, reasonable compensation for engagement in appropriate concurrent work and sparetime intellectual labor is bounded by the same lack of concern for seeking after personal gain as applies for the primary work."

However, beginning from the last half of last year, various restrictions have appeared on the participation of scientists and technicians in sparetime activities such as consulting. In general, those restriction may be summed as follows:

1. Leaders of the host unit must agree to sparetime employment, otherwise, they will be finding employment on their own, which is subject to criticism, bonuses will be affected, and advancement will also be eliminated.
2. Economic restrictions are tighter and tighter. As for example where relevant departments have ruled that the income derived by scientists and technicians from sparetime employment will be subject to temporary operations taxes, after which it will also be subject to an additional 0.7 percent municipal construction and safeguard tax based on the amount of other taxes paid. According to statistics, since the technology markets in Shanghai were opened up, the taxation rate on income from sparetime work has been raised on three occasions. Leaders have expressed worries about this, and the enthusiasm of scientists and technicians has been greatly affected.
3. Disciplinary and inspection measures have been adopted. Leaders of some units in Shanghai have made it clear publicly that engagement in sparetime work such as scientific and technical consulting is not permitted; those already so engaged must clarify their situation; those party members who do not do so will not be allowed to register during party rectification.

These restrictions have created a certain amount of turmoil among scientists and technicians, and a cold wave has broken over the once prosperous scientific and technical consulting activities. Those in charge of the municipal Science and Technology Association Consulting Center have worriedly said that even though there are many enterprises throughout the country that need consulting, scientists and technicians are concerned and do not dare take on new consulting services. Even consulting contracts already signed have no way to be completed on time because of the halt in the consulting business.

Why have these methods appeared that so restrict the sparetime jobs of scientists and technicians? Some have suggested the following analysis:

Foremost is that the concepts of leadership for some units are behind the times. They have dealt with new things and new situations that have appeared during the reforms with obsolete ideas and old habits. And they have regarded as mistaken things with which they are not familiar, to which they are not accustomed, and which are in fact correct.

Second, policy limits are not clear. Some of the policies proposed by regions and relevant departments have on occasion not been in keeping with the principles and policies of the Central Committee, and policies individually

formulated by various departments are not particularly uniform, and sometimes the policies proposed by the same department contain contradictions and differ greatly. This situation in which policies are coming from many sources without coordination has made it impossible for base units to comply.

Third, some have considered sparetime jobs for scientists and technicians as factors that affect production of the host unit. When the rate of growth for enterprise production has declined, blame is laid upon the fact that scientists and technicians participate in scientific and technical consulting. In fact, it would be hard to find a unit in Shanghai where production has declined because of sparetime employment. On the contrary, examples are numerous where development of scientific and technical consulting has motivated completion of major tasking and has accelerated rises in output value and profits. The Shanghai Textile Industry Design Academy began developing consulting services in the latter half of 1984, and scientists and technicians have actively taken on consulting projects in their sparetime, as lights are ablaze throughout all 10 floors each evening. Over the New Year holiday in 1985, many scientists and technicians voluntarily worked overtime, which both guaranteed that major tasking would be completed on time, and added to consulting income by 640,000 yuan. Gross income for the entire academy reached 3.5 million yuan in 1985 and profits were 2.06 million, which set a record.

Although many restrictions have appeared, many scientists and technicians are still willing to work in their sparetime. Problems that have arisen in consulting must be correctly resolved. The leadership and scientists and technicians of many units urgently hope that relevant departments will formulate more complete policies as quickly as possible that will actively bring on the healthy development of this business activity and that will safeguard the enthusiasm of scientists and technicians for making contributions to the drive toward modernization.

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NATIONAL DEVELOPMENTS

DECREASE IN S&T CONSULTING DUE TO CRITICISM DISCUSSED

Beijing RENMIN RIBAO in Chinese 8 Apr 86 p 1

[Report by Yi Xiao [5337 4562]: "We Should Pay Close Attention to the Drop in Scientific and Technical Consulting"]

[Text] At the China Science and Technology Association Technical Consulting Services working conference held 1-4 April in Beijing, representatives from all over enthusiastically discussed the accomplishments and problems in Chinese scientific and technical consulting services in the last two years. That science research units and scientists and technicians engage in consulting services is a new item of interest in the restructuring of the science and technology system. At this time, these people have formed a rather complete scientific and technical consulting service network throughout the country. This has trained a capable scientific and technical consulting service cadre contingent that has done a great deal of valuable work in the areas of organizing comprehensive economic decision making and serving enterprise technology. For example, the China Science and Technology Service Center has done a comprehensive scientific demonstration for an overall synchronized construction program for the coal, electricity, and transportation situation at the Jungar coal fields in Nei Mongol. This has been entered into the planning for the "7th Five Year Plan," and the northern railway construction plans have been approved and adopted by the State Planning Commission; the scientific demonstration of the water conservancy development and rational use program for the Huang He Hei Sanxia He section has received a very high evaluation by the Ningxia Hui Autonomous Region. The perspective on the development of the metallurgy industry and the more than 5,000 suggestions proposed by the China Metals Society on the major problems of technology transformation, importation of technology, and training of personnel during the period of the "7th Five Year Plan" have been largely adopted. In 1985, the five provinces and cities of Shanghai, Tianjin, Liaoning, Sichuan, and Shaanxi jointly continued 47,000 technical consulting contracts to serve small and medium enterprises and town and township enterprises, those contracts being worth 380 million yuan. Throughout last year, among the 23 billion yuan in transactions that were put into effect throughout the country through the technology markets, more than one-sixth were for science and technology consulting services. We ought to realize that in the current reforms of our economic and science and technology systems, scientific and technical consulting services have promoted lateral relations

between science and technology and production and between central cities and old revolutionary base areas, minority nationality regions, border areas, and impoverished areas, and have served as bridges and links. And they have played an inestimable role in making decision making more scientific, in hastening the transformation of science and technology into production forces, and in developing the potential of scientists and technicians.

The scientific and technical consulting that has arisen in just the last few years is just like other new things produced during the reforms: because of rapid development, certain relevant policies and management measures have not kept up with events and there have been problems in the work. But from the point of view of quantity, these problems have been only a minority of all problems, and some have even been unavoidable. According to statistics from 14 provinces, cities, and autonomous regions, such as Shandong and Yunnan, among 1,035 consultant service organizations, in the early period only 1.7 percent engaged in business, and no one was in violation of laws.

Consequently, because of these very individualistic examples, responsible departments in some areas have come up with a prejudiced view of scientific and technical consulting, either overtly or covertly considering scientific and technical consulting as "unhealthy tendencies." Some areas have drawn up various "local policies" to restrict scientific and technical consulting, which have created great pressure on those who engage in this work. For example, the effect has been great on an academy of design in Gansu Province having more than 800 scientists and technicians that because their planned tasking was insufficient developed a rather vigorous scientific and technical consulting service within and outside the province. However, under strong administrative pressure and pressure from public opinion, at the beginning of this year, the academy director of this academy was forced to proclaim that the academy was "washing its hands of it and would not get involved." The representatives at the working conference stated that through February of this year, the number of contracted transactions for scientific and technical consulting has dropped 80 percent over the same period last year and the amounts for contracted transactions have dropped by 90 percent over the same period last year. This situation of decline, a tendency that continues to develop, should attract a high degree of attention.

It should not be denied that unhealthy tendencies have made their way into the scientific and technical consulting activities of particular units, and that correcting these unhealthy tendencies is absolutely necessary. But in doing so we should make clear distinctions, should safeguard the reforms, and absolutely should not deal with new events in the reform with methods and efforts belonging to old thinking.

At the conference the representatives were unanimous in feeling that guidance, supervision, and checking of finances and taxation, auditing, and inspections are necessary in scientific and technical consulting. However, at present there is the situation in some areas whereby "new rules are meeting up with old judges." For example, for consulting services for small to medium enterprises locally determined limits are "words but no deeds," where once having acted one is engaged in production, which is not consulting services this limitation has caused scientists and engineers to complain endlessly.

Actually, for the great majority of small to medium enterprises, and especially the town and township enterprises, the general level of technology has not yet reached the stage at which problems can be solved with just a little direction, but rather must be a case of "full scale, integrated service." How we are to formulate appropriate "new rules" based on the new situations in which we find ourselves is a question in urgent need of resolution.

Reporters also learned at this conference that in large cities like Shanghai and Tianjin, where technical advantages are concentrated, scientists and engineers currently engaged in scientific and technical consulting activities are not even 15 and 20 percent of the members of all associations in the Science and Technology Association, so the potential here awaits a great effort at extraction. According to current estimates, this is not a situation of passive restraints, but of active guidance.

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NATIONAL DEVELOPMENTS

SHANGHAI S&T ASSOCIATIONS' CONSULTING SERVICES DISCUSSED

Beijing RENMIN RIBAO in Chinese 9 Apr 86 p 3

[Report by Ai Xiao [5337 4562]: "Science Braintrust Offers Suggestions and Mediates Disputes on Behalf of Economic Construction"]

[Text] Scientific and technical consulting services in the Shanghai Science and Technology Association system developed greatly last year, and they played a positive role in assisting leaders in scientific policy making, in supporting enterprises, and in improving economic and social results. This contingent of scientific and technical consultants has formed an important force with which to base in Shanghai as we cater to the entire nation.

In 1985, the Shanghai Science and Technology Association took on nearly 7,000 scientific and technical consulting projects, which was twice that of 1984; the amount of the contracts handled was 33 million yuan, 4 times that of 1984. For the 2,420 consulting projects that have been completed, the value reached 15 million yuan, which earned a direct profit to the state of 600 million yuan and provided activities fees to the Science and Technology Association of 240,000 yuan. Presently, Shanghai has signed technical consulting contracts with 26 provinces, municipalities, and autonomous regions, and has sent out more than 400 consulting service delegations, numbering more than 3,000 people, to 23 provinces, municipalities, and autonomous regions, which has shown off the technical advantages of the center and the city.

The "Baogang Changjiang (Reservoir Construction) Water Channeling Project Feasibility Consulting Demonstration" that won first prize among the first prizes given by Shanghai for scientific and technical advances in 1985 was a consulting demonstration for tracing policy making that was undertaken by scientists and technicians from many disciplines. It used scientific theories and technical and economic proofs to select and recommend that the Changjiang (reservoir construction) water channeling program replace the original engineering project that channeled water to Lake Dianshan 72 km from Baogang to one that opened up a headwater for water use at Baogang, which satisfied production needs, and which also provided a scientific basis for opening up industrial use of water at our coastal and river ports. This has strategic significance. This program allowed taking out good water from Lake Dianshan for drinking purposes for the residents of Shanghai, which had obvious social results; after Baogang had switched to using water from the Changjiang, more

than 50 million yuan was saved in project funding over the previous plan, there can be annual savings of more than 6 million yuan in shipping costs, and more than 25 million kwh of electricity is saved per year, with obvious economic results.

The Hengyang Bicycle Factory in Hunan is a test site factory for the Ministry of Light Industry. State investment has been 30 million yuan, with a designed annual production of 300,000 bicycles. Because of weak technical capabilities, confused management, high production costs, and low quality, in the 15 years since the factory had been built there had been losses over 11 of those years, until in 1984 losses reached 2.9 million yuan and plans had been made for its closure. The Yangpu District Science and Technology Association of Shanghai organized retired scientists, technicians, and technical workers to investigate and solve the difficulties. In only a year's time, product quality at this plant reached the A level, production quantities had greatly increased, costs had dropped 12 percent, and enterprise certification was obtained. In 1985, economic results of 10.9 million yuan were earned, which resulted in tax revenue of 6 million yuan. Through all of last year, about 300 factories were revived or turned losses into profits through the scientific and technical consulting services of the Shanghai Municipality Science and Technology Association system.

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NATIONAL DEVELOPMENTS

POSITION OF TECHNOLOGY DEVELOPMENT DEFENDED

Beijing ZIRAN BIANZHENGFA TONGXUN [JOURNAL OF DIALECTICS OF NATURE] in Chinese No 6, 10 Dec 85 pp 1-4

[Article by Chen Renpeng [7115 0086 7720], Chinese Academy of Sciences, Silicate Institute, Shanghai: "The Position and Function of Technology Development in the Academy of Sciences"]

[Text] The development of modern science plays an ever increasing role in modern technology and modern production. Generally speaking, the achievements of basic research must be dealt with by applications research before they can be transformed into practical technologies. This, while the achievements of applications research must go through various forms of technical development before they can then go on to be transformed into direct social production forces. Many people see technology development as the link between science research and production, which is quite appropriate. It not only links the two together, but is a two-way channel as well.

Full scale restructuring of the economic system has begun to unfold in this country, just as it creates an excellent environment for the restructuring of our science research system. At the same time as this country energetically promotes technology development, enhancement of applications research will then allow basic research to achieve a stable development. The Chinese Academy of Sciences will follow the instructions of the Central Committee in vigorously strengthening applications research, and will actively and selectively join in development, while continuing to regard basic research highly.

After several years of measured readjustment, there is increasingly clear understanding of this problem at the Silicate Institute, which is an inorganic materials science and engineering institute. Actually, research at this institute has been progressing in this direction in a measured way.

Leadership through the years at the Silicate Institute has felt that over a relatively long time, it is proper to maintain the general ratio in the three areas of basic research, applications research, and technology development at the institute at 1:5:4. Proceeding from the working foundation within the institute and the technical needs outside it, technology development cannot help but have a larger proportion. To urge that basic research be greater

than applications research would not be in keeping with reality, and for applications research to be greater than technology development is a natural thing. To generally feel that technology development is primary is a matter for the industrial departments, but for an institute of the Chinese Academy of Sciences that focuses on applications research, to increase that would be like doing something that is not one's true vocation, and if we had to do it, we would have an insufficient understanding of the importance of technology development.

In early 1984, while China's reform of the economic system had just begun and when town and township technology markets were rapidly developing, to adapt to this trend and force research to better cater to economic construction, leadership at the Silicate Institute began to realize that although the nature and function of technology development and applications research are not the same, for the kind of institute that the Silicate Institute is, we had to elevate technology development to a position of greater importance. It was then placed in equal importance with science research. We must "take on things with both hands." One hand is busy with applications research. One hand works on technology development. To this end, we immediately separately set up some of the people from the science and technology office who were engaged in management development into a technology development office. The results of this organizational measure have been outstanding. To adopt a more positive attitude toward technology development, this organizational step must be taken. The approach of organizing a development company could be used, or other methods could be used as appropriate.

In 1985, after the resolution by the CPC Central Committee regarding reform of the science and technology system, as animation in development work at the Silicate Institute developed and the sense of urgency regarding the reform progressively strengthened, the leadership came to understand even better that development is not only a problem that concerns how research at the institute is to cater to economic construction, but is also a problem that concerns whether or not this institute has any capacity for self development.

In work to develop lateral relations, the Silicate Institute has signed more than 860 contracts for the transfer of rights to technology and for consulting services with places all over the country. It has established 23 joint groups along various lines, as for example, through joint operations, joint funding, autonomous funding, etc., where the investment is intellectual or there is technology share-holding. According to the calculations of the office of development at the institute, production gross output value for 1984 could be about 120 million yuan, which would bring in more than 40 million yuan for the state in tax revenue. This not only allows the potential scientific and technical production forces that have been accumulating for years at this institute to be fully and rapidly transformed into actual social production forces, but at the same time can also form a rather stable two-way channel linking research to production.

In linking research and production, more than 150 scientists and technicians at the Silicate Institute have been hired in concurrent positions at production enterprises as engineers, technical advisers, assistant managers, vice chairmen of the board, etc., which has greatly enhanced the capacity for

technical development of these enterprises. Some new types of talent that both understand science research and production operations are currently being nurtured and are maturing. The Silicate Institute is the same as many of its siblings in that it has encountered many difficulties as it has broken the deadlock regarding the rational movement of personnel. How can it create certain conditions that will allow the transition of a number of concurrent posts into specialties, perhaps being able to open new roads for the reasonable movement of personnel, while on the other hand being able to provide and support manpower sources for research. The problems that are involved here are, of course, still thorny ones, but are worth exploring.

Through technology development, the Silicate Institute has received a gross profit of 1.44 million yuan through the first half of this year [1985], which is 3 times that of the same period in 1984. At the same time, we had signed contracts with various countries in North America and Europe and with Japan for foreign exchange values of \$3 million dollars, and it is estimated that \$1.4 million dollars can be earned during the year. The institute can then earn a certain amount of money for research development. To a certain degree, this can alleviate the financial difficulties the institute is currently faced with. If things do not go bad and there is ever more vigorous development, this financial source can be expected to become one of the chief sources for this kind of institute research operating expenses. It could provide financial support for research and at the same time a certain portion can be deducted according to rules as funds for benefits and for rewards, which could gradually improve benefits for staff and workers at the institute. The function of economic levers is becoming greater, the significance of which cannot be underestimated.

The outlook for technology development work at the Silicate Institute is a good one, for supply cannot keep up with demand in the technology markets. The institute director said early this year that: achievements we have had in the bag have now all been brought out. The office head of the office of development said: we have now reached the point where "it can be seen that we're married by the shape of our stomach." For achievements that have not yet come out, people are predicting that the majority of technical achievements that will be transferred outside the institute from technology development inside will be the accumulation of years of research. As for example the niobium-acid-lithium crystals and devices jointly developed and produced for color television with the Deqing Electronics Materials Plant in Zhejiang, which beginning in 1973 were the primary focus of the manual crystal laboratory. Or like the scintillation crystal germanium-acid-bismuth used in high energy detectors that is currently undergoing testing, which as a crystalline material began to be studied 5 years ago in response to the needs of the new CT technology in medicine. But what is used as the techniques and methods for crystal growing can be traced back 20 years, when the foundation began to be laid by techniques for the growing of compound mica. To maintain the good prospects for development, there must be sufficient reserve strength. It will not work if there is not sufficient research in reserve. Institute leaders have felt deeply that our reserve strength is not sufficient, and that we must "prepare for a rainy day" and not "wait until thirsty before digging the well." We must be prompt in adopting effective measures and vigorously strengthen applications research to develop and prepare the reserve strength,

for otherwise in less than 2 or 3 years we will be bogged down in passivity, which will bring on a crisis. Regarding existing arrangements for applications research, it is necessary that these be earnestly reevaluated in light of new trends, and that necessary adjustments be made. This new understanding of the importance of applications research and of the urgency of renewed consolidation is quite different from the starting points of the past. It is possible that this is motivated by the needs of the new operations systems as established in response to reform of the science and technology system. Ten percent of the activity at the Silicate Institute is basic research, and under stimulus by current trends in technology development, research personnel in this area will naturally feel somewhat insecure. As for example where a comrade who is engaged in using the Monte Carlo method to simulate crystal growth said worriedly at a conference, he has the feeling that his work may be cut off at any moment. Institute leadership has not forgotten the many lessons of the past, which clearly indicate support of work of this kind, and so have adopted measures to allow them to continue on without worry. At the Silicate Institute where applications research is of primary concern, there may be the need in the not too distant future to increase the proportion of that research, which shows its greater importance. This is not even a matter of choice today. If the position of technology development is not appropriate, and its relations with applications research and basic research are not handled well, history will be sure to lay blame. This is not something that can be ignored.

Relations in these aspects should be gradually rationalized in the reform. Trees have roots, water has its springs. Research should be the back-up of today's development work, and the reserve for tomorrow's development work. Technology development will enable applications research to be verified and rewarded. Both research and development ought to constitute complementary relations, that is, relations of mutual survival, intertwining, and mutual stimulation. The shoots can already be seen, so experience should be accumulated and understanding deepened in order to realize as soon as possible these favorable cycles.

The characteristics made up of proportions and relations between the three types of work in the Silicate Institute, as well as discipline and specialty structures and various operational patterns, have already allowed this institute to break through at an early stage the traditional pure research models. This institute is already a comprehensive institute that focuses on applications research, but also stresses development. We believe that an institute with this sort of blend ought to be quite representative of the Academy of Sciences. If there could be a large institute established on a solid foundation of applications research and that also had a strong capability in technology development, that had high standards of science and technology and yet also great energy for self development, the Chinese Academy of Sciences would certainly be greatly strengthened in its capacity to solve major science and technology problems in national economic construction.

Naturally, the Academy of Sciences should not stick to one pattern in allowing its affiliated institutes to be strongly individualistic in meeting the needs of science and technology and of social and economic development. Some stress basic research, some emphasize applications research, some focus on technology

development, while among all these is the institute that is a blend of all. At present, at the same time that the Academy of Sciences is vigorously strengthening applications research and steadily developing basic research, as far as technology development is concerned, as long as the road is correct there is no fear of doing too much nor of repeating, and this is especially true of technology development that can take laboratory work as a back-up and that has the capacity to enter and compete in technology markets. What we mean by the road being correct or not is mainly whether relations among the benefits to the three parties of the state, the group, and the individual are handled properly, whether or not there are instances of seeing only profit and not significance. Resolute measures should be adopted, including strict elucidation of projects and strict project accounting, which as quickly as possible will urge the Academy of Sciences to produce a group of development model institutes that have the vitality for self development. When there is a great deal of technology development work, when technology development type institutes are more numerous, this will not necessarily affect the development of basic research and applications research. On the contrary, it is entirely possible that this will be quite beneficial to the invigoration of the Academy of Sciences. Some institutes plan for 40 percent basic research, but in fact may have only 20 percent. Some institutes plan for 50 percent applications research, but may actually have only 30 percent. Current problems in basic research and applications research at the Chinese Academy of Sciences are possibly not for the most part affected by the amount of development, but possibly are mainly due to topic selection and the quality of cadres. As long as technology development work is not fighting with basic and applications research for operating funds and for food in the communal pot, then with great courage the reins should be slackened and research personnel encouraged to leave the Academy of Sciences and go to the technology markets to put their hands in. In summary, I believe that under conditions that do not affect the development of applications research and basic research, the potential that can now be extracted from within the Chinese Academy of Sciences and placed into technology development to make even greater and more numerous contributions to development of our production and to the prosperity of our economy is quite considerable. Looking at the Academy of Sciences through the eyes of the Silicate Institute, I feel that the Academy as a whole should grab hold of things with both hands, should rationalize its research and development relations, should set up complementary relations between these two aspects, and would by doing so avoid competitive and debilitating relations.

In light of current trends regarding open-door policies and large scale importation of foreign technology, there should be a full evaluation by this Academy comparing research and development. The Silicate Institute has been engaged in the study and development of optical communications and light-guided glass fibers for nearly 10 years now, and although for some years now many major scientific and technical achievements have made their way into factories, this cannot satisfy the demands of construction in optical communications engineering. The state must still spend large amounts of foreign exchange through the industrial sectors to bring in technology from abroad, especially to buy new technical equipment. Through accumulations of many years of research, although the Silicate Institute could fulfill certain functions in the aspects of feasibility studies and negotiations and assimilation, it has fallen into passivity. This one case is quite

instructive. If things go on this way, it is possible that our Academy and the nation could be faced with this grim situation with research and development related to the new technologies of important future projects. If the past is not forgotten, it is the teacher of the future. We absolutely cannot passively hold our own, and even less can we blame everyone but ourselves, but rather should revive ourselves and get active. We should strive to base ourselves on autonomous research, actively joining in development with foreign countries, and should strive for higher starting points and higher speeds for development. Of course, we should not get rid of joint operations within the Academy and within the nation. Explorations have already begun on this aspect, but for the time being there have not been successful experiences. It is my belief that technology development of this sort ought even to be more active than at present. And of course we want to fully utilize beneficial conditions in our institute to select carefully the objects of our attention, not wanting to take risks that are too great.

Many institutes within the Academy of Sciences are building affiliated development and experimental base areas. With the support of the state, this Academy is still in the process of building some experimental base areas that are Academy affiliated. As for example, the experimental base area for new materials in chemistry. Work at these experimental base areas, and especially the work at Academy affiliated base areas, should certainly be closely integrated with relevant research, and should develop in concert. Disjointedness should certainly be avoided.

Applications research and technology development at our Academy should be more academically nurtured to the greatest extent possible from the basic research at this Academy, and there should be greater mutual relations and mutual support in work. If applications research, technology development, and basic research at the Academy of Sciences can be well integrated, they will form an organic system that is full of vitality. Then, the Academy of Sciences would take off like a tiger with wings, and would be resplendent in our drive toward modernization. For these reasons, I believe the view that holds that we must split the Academy into two academies, where one deals with the basics and the other with applications, should not be adopted. It would be best to organically integrate these things and truly develop the comprehensive advantages that are present.

Discussing the relations between these three areas from the point of view of technology development, exploration of this problem can certainly not be replaced by a discussion of problems created through the joining of different disciplines and different specialties that cut across projects, institutes, and academies. In the development strategies for our Academy, problems in these two areas should actually be solved at the same time. Recently, the Academy has been in the process of organizing nearly 10 institutes of different types and different specialties to take on research and development of optical storage technologies, with the hope that they can create an example of how to make the most of the comprehensive advantages of the Academy of Sciences in these new times.

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NATIONAL DEVELOPMENTS

INTEGRATION OF JILIN S&T, ECONOMY DISCUSSED

Beijing RENMIN RIBAO in Chinese 9 Apr 86 p 3

[Report by Wang Jinghe [3769 2529 0735]: "The Integration of Science and Technology with the Economy Moves Toward a Systematic Institutionalization"]

[Text] In treating promotion of the integration of science and technology with the economy as an important strategic measure for revitalizing the economy of the entire province, Jilin Province over the past 2 years has put into effect a series of reforms that promote continuing steps toward systemization, institutionalization, and regularization for this integration. They have worked to accelerate the transformation of scientific and technical achievements and the development of local economies.

At present, the situation in which provincial science and technology is divorced from production is already changing, and the spontaneous, temporary, and disorganized conditions of the last 2 years are being transcended as more and more science research and teaching units have established long term stable cooperative relations with the economic sector and with production enterprises. According to statistics, there are more than 1,300 science education and production joint operations and integrated units throughout the province at present, 89 of which are affiliated with commonly funded, mutual risk, shared profits integrated bodies. Of the scientific and technical achievements that could be disseminated from the 796 projects that have been obtained since 1984, the achievement transformation rate has been 71.6 percent.

There are 172 independent science research institutes and 45 institutions of higher learning in Jilin Province, and the scientists and technicians are among the front ranks in the nation in proportion to the provincial population. To transform the scientific and technical advantages into economic advantages, in 1984 the province arranged for 10,000 scientists and technicians to go to factories and to the countryside to develop technical consulting and trouble-shooting. It was also arranged that persons in charge within responsible sectors of the economy and from nearly 1,000 enterprises would visit higher institutions and research units, all of which had outstanding results.

Jilin Province has adopted a series of measures to further the integration of science and technology with the economy. First of all, they have changed the situation in which science and technology is controlled solely by the science and technology commissions, and have set up leadership structures for direct guidance by the provincial government and for the integration of science and technology with the economic sector. Science and technology leading small groups have been set up in the province, the heads of the groups being comrades of primary responsibilities in the provincial government, and the provincial government directly organizes and coordinates major problems that concern various bureaus.

In addition, they have also changed the planning and management systems to promote integration from various angles. In the areas of planning and funding structures, they have focussed on arranging developmental research. There were 351 projects as part of provincial planning last year, 271 of which were development research and applications that could be expected to be useful in the near term.

Third, they established a system for the management of scientific and technical achievements and a responsibility system for transfer and dissemination. The provincial science and technology commission is in charge of registration of scientific and technical achievements throughout the province, and for statistics, gathering, and shipping for achievements that can be sold, and they will also take charge of dissemination of achievements in the areas of culture and education, hygiene, and agriculture together with relevant bureaus; provincial planning and economic commissions will be responsible for the dissemination of achievements in areas like industrial transportation, capital construction, and commerce with relevant offices throughout the province.

At the same time, they have called get-togethers, networking meetings, and specialty topic conferences, and have established channels for relations between research and teaching units on the one hand and economic departments and production enterprises on the other.

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NATIONAL DEVELOPMENTS

SPECIAL FUNCTIONS OF RESEARCH ORGANIZATIONS EXAMINED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 2, Apr 86
pp 33-35

[Article by Xu Qingrui [6079 1987 3843], Zhejiang University: "Exploring the Special Functions of Research Organizations"]

[Text] The resolution by the Central Committee regarding restructuring of the science and technology system opened a broad new future for the development of China's science research mission and greatly strengthened the vitality and impetus within science research organizations. Catering to society, there is already a tendency for branch research units to be progressively constituting independent research development entities. To adapt to this change, research units must strengthen their science research management, one point in which is very important, namely, improving the quality of research personnel, that is, to select and supply various types of people who are suited to engagement in research activities.

With what qualities and functions should research personnel be provided? This is an important question worthy of a thorough analysis.

Whether a research organization can be truly successful, whether it can produce research achievements with outstanding results, depends to a great degree not only on the scholastic standards, sense of commitment, and strong sense of responsibility of scientists, but also on whether the organization itself can provide personnel who have many important special functions (of course, these special functions could also be present in the scientists themselves).

Five Important Special Functions

To effectively accomplish science research tasking and to allow achievements to be broadly applied, first level research organizations must also provide the following five functions in addition to providing research talent with high standards:

1. The function of generating new thinking. The ideas for new principles, new products, and new techniques are primarily obtained through analyzing information regarding markets, technologies, and techniques. If the function

with which a research organization generates new thinking is vigorous, there will be sufficient innovative vitality within this organization and everywhere will be dynamic.

2. The function of start-ups, or we could say the spirit of entrepreneurs in the front lines of science and technology. This is an opening up and maintaining function. When a new idea has been tested and verified, then difficulties should not be allowed to stand in the way, but ways should be found to realize that new idea. Actually, realizing new ideas always requires more effort than does generating new ideas. Without the innovation of entrepreneurs, the spirit of willing to take on risks, and firm resolve, new ideas would never get off the ground.

3. The function of leading projects and coordinating relations between people. Lacking the leadership function, there is no way to coordinate and accommodate research personnel, a tendency that would certainly affect the quality, standards, progress, and results of science research achievements.

4. The function of collecting and facilitating information. In this information explosion world of today, science research must open the channels for information and relies upon broad-based information processing. It must not only transmit outside technical information to the scientists and technicians in its own unit, but must also free up information channels within the unit. If this function is not respected, it can very well lead to the situation in which projects have gone on for a half year before it is discovered that the original project under study is out of date or backward.

5. The function of guiding and teaching young scientists and technicians.

A number of the five functions just mentioned are unique and unorthodox.

By unique we mean that these functions are special functions and that they are not things that just anyone can take on, that require people of a certain quality and accomplishment to take charge of. Generally speaking, from 70-80 percent of scientists and technicians cannot successfully take on functions in these areas, rather only a few talented scientists and technicians can personally take on different functions and be effective in these different aspects.

By unorthodox is meant that these functions are difficult to specifically explain and provide for in a working context, nor can they be included within the rules and regulations of the organization.

Although the five special functions described above are not science and technology itself, they are all organic components of the science research and innovation process, ignorance of which would bring unfortunate consequences to science and technology.

Those Responsible for the Function of Opening Up Information: Technical Link Personnel

Scientific and technical activities are "flows" that generate knowledge and that continually develop. This "knowledge flow" is also an "information flow." Science research activities are processes that continually generate new knowledge, and that at the same time are processes that continuously handle and process information. For this reason, scientific and technical activities are essentially an information handling activity.

The first question that scientists and technicians must face is obtaining and resolving the various information needed to carry on scientific and technical activities. The function of collecting and circulating information has become the key to whether research organizations can obtain results.

The function of getting information through is generally taken on by technical link personnel in the research organization. We can also call technical link personnel "technical key personnel" or "technical core personnel," for they are not appointed by higher levels, but are instead come to be naturally within actual work.

Actual practice has shown that whether they are large research units or are small project groups, in information contacts networks that overlap horizontally, it is always or nearly always possible to discover the "link personnel." They bring in outside technical information and broadcast it within the particular unit, which allows the transmission of technical information to change from a single shift to a process of a "two-step shift." This process of a "two-step shift" has produced unexpected results. Through the process of "absorption--assimilation--dissemination," outside information has been allowed to become easily absorbed "jargon" that integrates particular units and professions, for which reason the transmission of information has become even more effective. The following diagram is a sketch of the information "two-step shift."

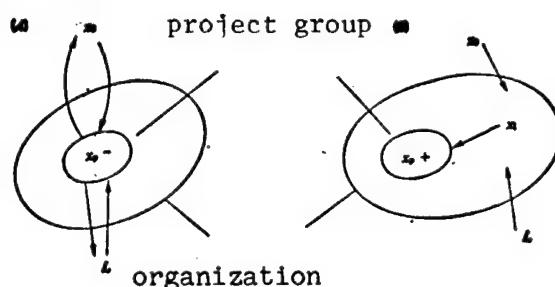


Diagram of the Two-Step Shift of Information

where, x_0 : scientists and technicians outside this organization
 x_p : members of project groups that need information
 x_i : technical link personnel
 L : written information
+ : good results
- : poorer results

Capable technical link personnel can cut across many of the boundaries of information links to act as full links in the transmission of external information.

The Characteristics of Those with Special Functions

In a research organization there should be people who have various special functions, which will allow them to each develop his unique function, where each will develop his strengths and supplement his weaknesses. This will allow the group effect to be fully played out, ensuring smooth completion of the research mission.

Those responsible for special functions have distinct characteristics in all aspects.

A creative scientist or technician good at generating new ideas is a special talent, and needs to be selected for nurturing and must be managed with special methods. For example, in arranging tasking we cannot be too strict in scheduling, but should provide adequate time to allow them to learn of other information and to be innovative in independent thinking. In addition, we should allocate to these people of unique creative abilities work at a higher level of creativeness, and also allow them to work on their own. They are always specialists in one or two fields, good at creating concepts, theories, and abstract thinking, fond of making contact with new things and using different ways to solve problems, and good at seeking out breakthroughs and working innovatively.

Supporters of technology, entrepreneurs with an innovative spirit, are also a kind of specialist talent. They are creative, but are even better at promoting creativity. They are suited to the transmission and broadcast of new thinking and products, and they are even more suited than scientists and technicians in their enthusiasm for dissemination and innovation. They often take risks, can win over resources, handle affairs in a decisive manner, have a wide-ranging enthusiasm, and have a great capacity for supporting other people.

Those who can effectively guide and manage projects are yet another type of person. They are people with an ability to organize and who are good at coordinating different types of people. They understand and are familiar with many disciplines, and know as well how to fit in, are good at using information for decision making and for solving problems. They are quite sensitive to the needs of others, can encourage others, and can make work proceed effectively.

Technical link personnel are both links by which outside scientific and technical information is brought in and are links through which scientific and technical information from research and development sectors is transmitted. They are highly technical, and through the various means of journals and conferences can keenly obtain relevant outside information, and they take delight in passing on information to co-workers in their organization, are fond of getting close and cooperating, are willing to help others face-to-face, enjoy high prestige among colleagues, and can informally coordinate personnel, all of which makes them an important source of information.

Those who are in charge of the guidance and teaching functions are, generally speaking, older, experienced project guidance personnel or are people who

earlier undertook ground-breaking work, and they are more amiable and easier to approach than the average person. Those persons at higher levels and of earlier generations can guide and teach the normal members of a group and can also carry on a dialogue with leaders at higher levels. These activities create important conditions for the effective progress of new thinking and new projects. When leaders of research units can be coordinated uniformly with those who academically are of an earlier generation, then these units can be successful.

The facts have shown that when many research units have produced few achievements and have low results, a primary factor is that their organization has lacked personnel with the special functions just described. This point should elicit our attention, and should be studied and resolved conscientiously in research management.

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NATIONAL DEVELOPMENTS

SYSTEM OF RESEARCH INSTITUTE MANAGEMENT PROPOSED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 2 Apr 86
pp 41-45, 35

[Article by Huang Desen [7806 1795 2773], Ministry of Aeronautics Industry, Institute No 601: "The Establishment and Strengthening of the Management Systems in Science Research Design Institutes"]

[Text] In highly complex societies, due to increasingly narrow divisions of specialist labor among individuals and organizations as science and technology develop rapidly, the success of a complicated engineering production design depends not only upon the extent of the science and technology potential of research departments, but also upon the standards of organizational management. Because of constantly increasing demand for new products in the marketplace, as well as a quickening pace for the renewal of products by advances in science and technology, there is a similar demand to adopt more effective management and optimal organization.

If a department is to pay close attention to science management, it must pay close attention to the establishment and implementation of science research management systems. "You can't make a circle without a compass" is a simple truth the ancients derived from actual experience. How science research management systems are to be well established and implemented is also closely related to whether the management concept is scientific and whether measures are powerful. How each research design department is to enhance science research management based on the characteristics of their own work has become a question of joint concern for every management person, especially because the development of reforming trends has been so quick, and science research design is currently faced with the challenge of the new technical revolution and increasing fierce competition. This paper attempts to analyze and explore some knowledge and methods from the actual experience of recovering, rectifying, and establishing the vigorous development of a science research management system for the Aviation Model Research and Design Institute in the process of model research and design during a period of quality consolidation and full-scale enterprise rectification, presenting this for discussion.

I. Primary Characteristics of Aviation Research Design

The Aviation Model Research and Design Institute is a national defense research unit, the primary missions of which are to study and design new model aircraft, and to provide modern military weapons and equipment (products) for troops (users), both to enhance the real strength of national defense. There are many differences between this and the civilian industries.

1. The aviation industry is a typical type of technology intensive industry, where the manufacturing technology of modern aircraft is extremely complex, it is very exploratory, and there are many uncertain factors. Aircraft research and design is itself a process directed toward design goals that is constantly generating science research reports (information), and is a process that constantly resolves uncertain factors as design and experimental work unfolds. Therefore, to a great degree its production and development depends upon constant control and operation of the newest scientific and technical achievements.
2. The objects of research design are very comprehensive, systematic, and task oriented and they are part of the coordinated problem solving of many disciplines. The cooperative relations are not only between the departments of the aviation industry, but are broadly connected with various other departments in the national economy. And the concept of time in the cooperative mission and the requirements of technical goals are both very high, so there must be strict organization to fully ensure coordination.
3. The quality of aviation products have an especially important significance that affects the outcome of war and human safety. For these reasons, there are many quality goals, requirements are high, control is strict, and there must be full scale quality control that is a "total process, done in stages" from the stage of feasibility demonstration to the stage of production of the final model using high quality science research to ensure the manufactured quality of the new machine.
4. Development and production expenses are great and turnaround is long. Because aircraft construction is constantly increasing in complexity, there is more equipment, techniques and technology are constantly improving, and the pace of technology renewal is so fast, which means that development and production of new machines requires large expenditures of financial, material, and labor resources. Development expenses for modern fighter aircraft can range from several hundred million yuan to billions of yuan with a development time as long as 10 years. Obviously, the problems of improving economic efficiency and reducing development times are very prominent.

We can see from this that the management task for the Institute of Aviation Research and Design is an extremely onerous and complex one. It is just as a foreign management authority once said, "The success or failure of a complex aircraft production design might depend more on the 'management gap' than the often mentioned 'technology gap.'". Consequently, the analysis and exploration of how to manage the Institute of Aviation Research and Design well is not

only very important for the aviation industry sector itself, but also has significance as a universal model for other defense industries and research and design institutes in the national economy.

II. To Manage Science Research Well We Must Change From Administration by Individual to Administration by Law

For more than 30 years, "leftist" influences and interference and destruction by the "gang of four" forced China's aviation industry to proceed along a precipitous and tortuous path. The collective result of these conditions can often be seen in the passive aspects and instability in the problems of product quality and of economic results for enterprises. A few examples will illustrate:

1. During the periods of the "great leap forward" and the "10 years of upheaval," because of blind pursuit of high production value and high quotas, undertaking the so-called "eradication and rebuilding," opposing "pressure from management obstructions," eliminating checks, and getting rid of a reasonable system of regulations, and consequently bringing on several disasters over that period involving quality reversals.
2. Reviewing the history of new machine designs, valuable time has been lost in vain due to hurried project starting without full demonstrations and insufficient preparation of conditions, which ended prematurely and resulted in the expenditure of large amounts of financial and material resources, and which has delayed the course of aviation science research development.
3. Quality accidents that have happened and work efficiency that has not been high is directly related to disorderly management. If the responsibility system is now not strict and responsibilities are not made clear, as soon as there are regulations to be followed and violations are investigated, the situation is sure to take a clear turn for the better.

As we have just described, the effects of whether or not there is scientific management are extremely far-reaching. Overall, if policy making is in error, this will affect national economic development and the success of undertakings; in the near term, it will affect the quality and results of a particular job or product. And the position of science management and the degree to which it is respected depend first of all upon national principles and policies, and for a particular department depends first of all on the management concepts of major leaders and the degree of perfection of the system of rules and regulations.

There are two management concepts that must be reformed.

One is doing things by administrative order or the wish of a high official. When in management there are no clear working procedures or responsibility system, to which is added the fact that certain leaders have no specialty but like to "supervise," and that in major policy making as long as a minority of leaders have the final say, then as soon as gross errors are made, there is no one to take responsibility nor any way in which to assume it.

The other concept is the use of technology to replace management. For some comrades who have taken leadership positions from the ranks of professionals, it is easy to revere technology over management because of their personal experiences. They are extremely sensitive to the contradiction of the technology gap but easily neglect the problem of the management gap. They see only the restrictions in the system of rules and regulations, and cannot see their functions of promoting and guaranteeing. Moreover, when there are conflicts between science management and the thinking, methods, and customs of traditional management, or with the management system, it is easy to pit technology against management and to see science management as an added burden and as an "elastic" assignment.

Comrade Deng Xiaoping has clearly pointed out, "Do not change as leaders change, and do not change with the changes in views and objects of attention of leaders." He has urged on several occasions that "We must review both sides of our experiences and must recover or establish a system of rules and regulations." These words are in light of historical experience and get right to the heart of enterprise management. Advanced industrial nations see a system of rules and regulations as the laws of an enterprise, as the basic condition under which they realize management functions, and also consider the system of rules and regulations for enterprises in the category of management standards. Consequently, they allow the task of enterprise management to be ordered, systemitized, and standardized. As everyone knows, Japan has taken management standards as the basis and criteria for promoting full scale quality management, which has then allowed product quality and management efficiency to surpass quickly that of the United States. And they have effectively corrected the abnormal phenomenon of the past which held that "as long as people stayed there is order, when they leave there is chaos" and allowed the transfer of individuals. Therefore, to strengthen science research management, we must change the "control by individuals" to control by law" and establish a set of laws and regulations for effective science management.

To emphasize "control by law" is definitely not to deny the subjective dynamic role of people. On the contrary, laws and regulations can allow all levels and aspects to operate in accordance with unified laws, which will guarantee that enterprises can operate regularly, can realize effective control, and can guarantee coordinated work. In this way they can even better cooperate in different tasks, each getting what it needs.

A system of rules and regulations is a specific realization of the integration of management concepts with actual practice. With a scientific management system, we can accelerate the transformation of advanced science and technology into useful products and social wealth.

Practice has shown that the management methods of advanced enterprises always closely integrate advanced science and technology with scientific management methods to act as two vehicles for carrying the rapid and steady development of the economy. And on the contrary, units of deficient quality, low efficiency, or unstable results either have backward management methods or do not pay close attention to science management.

III. The Basic Requirements for Formulating a System of Science Management

1. Directive

A science management system is basic rules and regulations that use policies, that organize, guide, control, and coordinate science research and design activities. Consequently, it must be a review of experiences from the actual practice of research and design work, as well as a rational development of perceptual knowledge. What kind of system a department or project actually sets up, what problems each system must solve, should proceed from reality, should be considered in total, and should be arranged in a unified manner. Judging from the present, we should first of all focus on the tasks of responsibility systems (and especially the position of important interfaces and the division of labor problem), work procedures, working methods, and work standards. After the system has been established, we must emphasize thorough implementation, where leaders at all levels serve as examples, take the lead in implementation, and where management departments make investigations, for otherwise if a system is good but is not implemented, it is a mere scrap of paper.

2. Systematic

A science management system must be suited to the characteristics of aviation research and design, and must be worked out as a whole. Development of modern aircraft is a complex systematic project, for every link, every job, and every department must constitute a system that is a coordinated whole in accordance with the principles of a system project, where there is mutual coordination both vertically and horizontally. For example, vertically, we should establish a technology management system for each design stage according to the requirements of the order of model design; laterally, we must set up full scale systematic provisions for management of each function, such as for planning, quality, economics, education, archives, and information. The organic integration of the vertical and horizontal constitutes matrix management of the whole model design.

3. Integration

Each particular matter, each influential factor, each explanation, and each style of form that is relevant to the system should be made provisions in a logical order. In general, a larger system would include: basic principles, job tasking, assignment of responsibilities, methods of implementation, and various explanations and forms, for which we should strive for integration, clarity, and ease of thorough implementation.

4. Suitability

Research and design is a development activity for new technologies, where conditions are constantly changing. To allow research management to be regularly situated in an optimal state and to receive the best management results, the research management system should be appropriately revised and perfected as it adapts to objective changes. Therefore, the science management system is not like the system of regulations for production

departments, which can be relatively stable for long periods. For example, with the problem of division of responsibilities, because of the constant development of design technologies and the appearance one after the other of new specialties, former divisions of labor must be appropriately adjusted and reclarified; design sequences and management methods must be progressively detailed, revised, and replenished according to new experiences and new situations. Therefore, we must regularly gather reactions and questions from all areas and suitably revise things to guarantee the active effectiveness and suitability of the system of rules and regulations. We cannot have the same system for several years. Of course, neither can we keep changing all the time, to rashly deny the system that has been established. Major alterations or modifications should be carefully studied, for overall we want to maintain a relative stability. Managers must analyze in detail how these two extremes are to be properly handled.

IV. The Categorization of Research Management Systems

To aid in the goals of management, systemization, and improvement in completeness, we have derived five categories based on the characteristics of design management and specialized subject matter (see table at end of paper).

1. The Responsibility System

This provides the working scope for each department and each type of personnel and the responsibilities that should be fulfilled, which include:

Organizational structure-- the organizational format of the management system and corresponding subordinate relations;

Range of job responsibilities-- the working scope of each department. We must clearly formulate and coordinate the working relations between interacting parts.

Personal responsibility system-- the job responsibility that all categories of personnel should assume. This may be carefully separated into a technical responsibility system, a quality responsibility system, and an economic responsibility system, in which the working core is the technical responsibility system at each level of the chief design engineer system, and which is the primary object of research management.

2. Model Design Management

The various management systems directly related to model design technologies. They are generally listed under the categories of research programs and specialist categories, as for example, overall coordination, weight control, etc.

3. Management of Special Technologies

The management structures of each job and the management system, regulations, provisions, methods, and detailed rules for the implementation of the management functions of various specialties, as for example planning management, quality management, economic management, and education management.

4. Work programs

When taking any particular job, make strict provisions for the work to be done according to the steps in the job and their sequence. This allows for modularity, rules, and sequences, where a work process cannot be disregarded, reversed, or left out, and by which the best quality of work and optimal work efficiency can be had.

For design departments, those that are most important are the various design sequences, experiment sequences, calculation sequences, and work regulations.

5. Work Standards

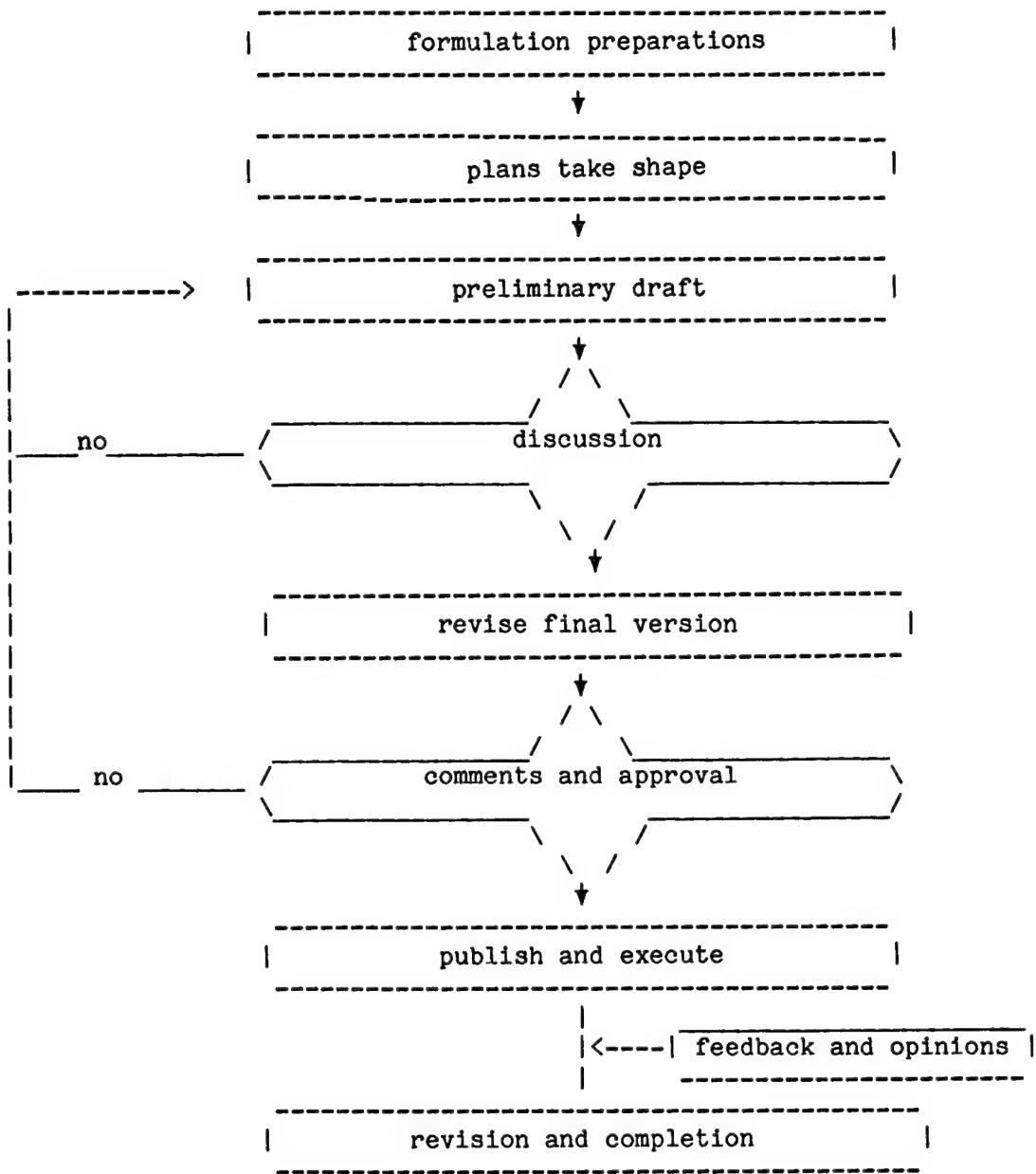
These are the evaluation norms for judging work quality, and are also examination standards. For example, when completing a particular design task, the stipulated level and degree or job target should be attained, for which should be sought quantified, statistical, or comparable levels, such as 'superior,' 'excellent,' 'qualified,' 'not qualified,' etc.

The various categories of research management systems just described are mutually related and mutually complementary, but each has its leanings and characteristics. To allow management standards to become gradually systematized, I feel that just how these things are reasonably categorized is a new topic that should be explored for standardized work.

V. Drawing Up a Work Program for Research Management Systems

To draw up a research management system according to a management standard model we must unify the provisions of the format, sequence, and conditions of the formulation and of the formulation requirements. And we should also determine a department head formulation plan and organization coordination.

The sequence I have worked out for research management systems is as shown in the following diagram.



Flowchart for Make Up of a Research Management System

1. Preparations for formulation: this primarily determines the material to be worked out and organizational preparations for the formulation work, as for example, the questions of what to write, how to write, and what will be written by whom.
2. Forming the plan: based on the proposed topics for formulation, and after receiving approval from the leaders in charge, list formal work plans. Planning topics are to be unified and arranged by the management department in charge, to be assigned at the beginning of a year or any appropriate time, and if a supplement is needed, then that can be added provisionally.

3. The preliminary draft: the standard of the initial draft plays a big part in the quality of the document, for which reason it is best if the drafting is the responsibility of leaders themselves or of key technical cadre. By collecting together their many years of work experience, this will ensure the feasibility and completeness of the system. The drafters must have an overall viewpoint and scientific attitude, and must beforehand diligently gather relevant materials, broadly elicit opinions, and review experiences and lessons; the materials that are included should be clearly specific, thoroughly feasible, and verifiable; certain problems that for the time being cannot be determined should not be forcibly included; the writing should be complete, concise, and coherent.

4. Discussion: relevant departments and personnel should be organized into full scale discussions according to the material in the documents and to the areas covered by it; major problems should be discussed over and over, seeking for unanimity; the person in charge should prepare well, should explain the situation, and should propose the major questions for discussion.

Discussion is not just for unifying knowledge, but for enriching the material. It is also an occasion for explanation and a deepening process, with great advantages for the future implementation.

5. Revision and the final manuscript: here, the opinions from the discussion should be accurately considered, and the language and format should be standardized and unified. Problems that have not yet been solved should be referred to the leadership for a ruling.

6. Comments and approval: the drafters should try to coordinate matters that involve relevant units, and then the two or more parties should agree on a time for signing to show joint responsibility.

Attention should also be paid to coordinating a joint signing when the leadership is to approve, so that the approval can be released.

7. Publication and execution: through the unified release by relevant management units, this will allow the document to be easily implemented, and the area of distribution should be as broad as possible, with one copy for each person likely to use it. The formulating unit should proceed from the idea of developing the task of that department and take responsibility for organizing implementation of this system, and should be responsible for solving and handling problems that arise during implementation.

8. Revision and completion: opinions and questions should be regularly solicited and the document periodically put in order and revised. There should be emphasis on investigating and the controlling the following problems:

a. The situation under which the system is implemented and questions that arise therein.

b. Whatever rules need revision and completion should be revised before they can be considered complete;

c. To improve the effects of implementing this system, what other opinions and suggestions are there;

d. What opinions and requirements are there regarding management in the research management system, and how can the results be made even better.

In summary, the "form-- implement-- revise" process of this system is an ever deepening and progressively improving process in the work of research management.

VI. A Rudimentary Understanding

1. We should continue to make great efforts at publicity, at improving understanding, and at improving efficiency.

There are at present difficulties and obstacles to the promotion of research management, but the confidence and zeal of leaders at all levels and of vast numbers of research personnel is still on the upswing. Because the work positions of research and management personnel and their sense of mission differ one from the other, it sometimes happens that certain contradictions are common occurrences. Because research personnel are most concerned about opening new fields in science and technology, while management personnel want to accomplish and organize their management tasking, this greatly limits making the most of the benefits from resources, but they can certainly work together at a common goal.

If we are to allow research management to develop thoroughly and protractedly, the main problem at present is still in improving ideological understanding. We should begin from two aspects: one is that if we are to improve rational understanding, we should study some basic knowledge in management science that is related and should relate some advanced foreign and domestic management experiences. We should enrich and renew management concepts, and should spur on our own confidence and determination in realizing science management with a spirit of reform; in another sense, we should improve perceptual knowledge and should review empirical lessons on both sides of issues in normal management work. We especially should use particular results to analyze and compare, should publicize and educate the leaders at all levels and the vast numbers of researchers, should enhance the concept of rule by law, and should open up new aspects.

2. We should make management responsible, and should not have too many ins and outs.

We are just entering a technical society that is increasingly complex and of even higher levels. If we are to accomplish our development mission for large scale armament systems, we must rely upon the management principles for system projects. To this end, the work of management must also stress systems

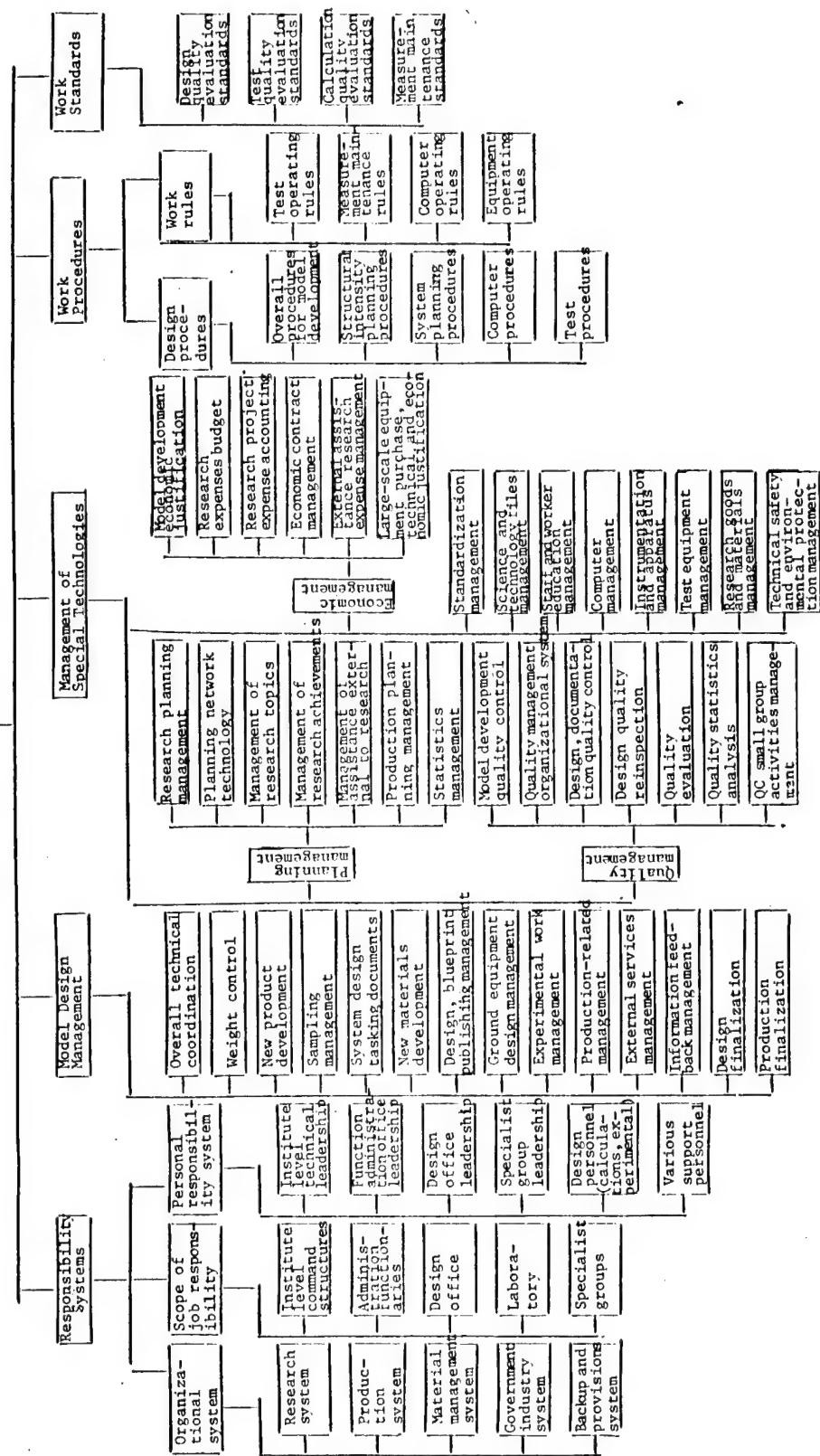
management. Because at present work within guiding departments and working departments is not coordinated toward the greatest effects from management, it is our belief that:

- a. Government organizations at all levels should meet the current needs for reform of the system, should focus on solving some problems in theoretical understanding and management policy that have been a source of contention for some years. Management rules and regulations that are promulgated should be revised and completed in a timely manner, and should pay special attention to lateral coordination between the various responsible departments.
- b. Management standards are like technical standards in that there is hierarchical management. Topics that are worked out should form a series table, with a planned, organized implementation.
- c. Each enterprise should establish responsible management units according to specialty systems, they should carry out unified centralized management principles, sequentially develop in keeping with the requirements of goal management, and should clarify the responsibility system and relations between divisions of labor.

3. Management goals should be quantified.

Quantification is an important characteristic of science management. People see management work as a kind of "expendable" tasking, one reason for which is that there are many requirements in setting management goals, while quantity indexes are few, which does not make specific checking and testing easy. Add to this the fact that the majority of research work is creative mental effort, quantification is difficult, there are great gaps between specialties, and quantities of work are uneven. All of these problems are topics of study with which management science is faced. For this reason, research management personnel must get to the bottom of facts, should always operate under management rules, and should make management goals quantified as much as possible, and allow management to become a rigid index. This is the direction and path by which to improve management efficiency and to put a new face on management.

System Categories for a
Science Research Management System



NATIONAL DEVELOPMENTS

MANAGEMENT THEORIES DETAILED FOR INSTITUTES UNDERGOING REFORM

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 2, Apr 86
pp 47-50, 40

[Article by Liu Fohua [0491 0154 5478], Ministry of the Electronic Industry Institute No 29: "Some Problems As the Military Industrial Research Institutes 'Change'"]

[Text] The resolution by the Central Committee regarding a reform of the science and technology system clearly pointed out that the direction and tasking of the reform of national defense research organizations would be in realizing several "changes." This paper discusses some problems in effecting those "changes." Although there are undoubtedly errors in this paper, the intention is to break ground so that others may continue and urge on the reform.

I. The Basic Concept Regarding "Change"

The basic situation currently in effect in the national defense research management system is: 1. Tasking is determined by the state, and the operating expenses of science research administrations are allocated by the state. 2. There is only research into military goods, not those for civilian use; military research achievements cannot quickly nor very effectively become civilian. 3. There is no consideration of completing directive planning, no concern about extending operations, no interest in economic results. 4. Control from the top is stifling, and there is no autonomy for the institutes. In this way, the research institutes have formed research institutes that are "pure military industrial models," "pure research models," and "closed models" (collectively called the "old three models"). Abuses in this kind of management system lie in the fact that the institutes eat from the state's "communal pot," the staff eats from the state's "communal pot," everyone's hands are holding "iron rice bowls," and there is no concern that there may not be anything in the pot to eat. For this reason, there is no pressure, motivation, or vitality in the research institutes. Actual practice has shown constantly that they no longer meet the needs of the "four modernizations," and that they seriously obstruct realization of the strategic principle that "economic revitalization will depend upon science and technology, and science and technology must cater to economic construction."

In the spirit of the "Resolution by the Central Committee Regarding Reform of the Science and Technology System," reform of the national defense research organizations will result in "three changes," namely: allocation of research and administrative operating expenses by the state through the administration system will change to a compensated contract system (through signing of vertical and lateral contracts) and a science base fund; there will be a change from an exclusive military goods model to an integrated military-civilian model; there will be a change from a purely research model to a research-production operations model that caters to society, caters to economic construction, and that opens technology markets to become institutes of the three new models of "military-civilian integration," "research-production operations," and "open."

This is a fundamental change for the research management system. The "old three models" represent the backward management models of the 1950's, which centered on the fact that all work carried out instructions from above and that are characterized by "waiting, dependence, need, and reporting." By 'waiting' is meant waiting for higher authorities to issue directive planning, by 'dependence' is meant depending on the state for allocation of funds, by 'need' is meant that the higher authorities were needed to resolve problems and difficulties, and by 'report' is meant that when planning had not been accomplished there was reporting to explain the reasons and to adjust the planning. The "new three models" represent a model of modern science management that is characterized by enhanced operational decision making, energetic development of civilian goods, the opening of technology markets, an improvement in technical, economic, and social results, and achievement of a basic self-sufficiency in operating expenses, all under the premise of accomplishing vertical and lateral contract tasking for military goods.

II. Changing Concepts Is the Ideological Foundation for Realizing the "Three Changes"

To realize the "three changes," we must change old concepts, old habits, and old methods that are not suitable to them, foremost of which is changing concepts. When concepts have changed, habits and methods will change along with them. So, what should be changed and what concepts should be established?

1. The concept of time.

There is a proverb that goes: "Comparing an inch of light and an inch of gold, the inch of gold cannot buy the inch of light." This concisely elucidates the value of time. If when taking on an expansion of operations, development of technology markets, and getting involved in competition, if there is no concept of time, then these activities can never be successful. However, as it happens, our current concept of time is deficient. As our mountains of documents are excavated, the higher they grow. As our seas of meetings are filled in, the deeper they become. Talking acts as reporting, and repetitious wordiness keeps people from understanding the main points. Disputes over trifles and insignificant wrangling is still in evidence everywhere, there is no feeling of urgency about accomplishing anything, much valuable time has been lost, and time has become a worthless object.

2. The concept of results.

Because military industrial institutes have for a long time had funds guaranteed by the state, there is a provisions system way of thinking, and many people have a poor or even non-existent sense of results. Therefore, research does not take costs into consideration, money is spent extravagantly, there is serious evidence of waste, there are great expenditures, and there are many loopholes. With a concept of results, there is sure to be an enhancement of management, the conditions above would be largely reduced, and economic results are sure to be greatly improved.

3. The concept of efficiency.

The greatest problem in the entire economic system of this country (including the military industry institutes) is not one of quantity, but is one of quality and management efficiency. Many management personnel lack a concept of efficiency, they are slow about doing things, and they are not efficient. With a concept of efficiency, there would certainly be a streamlining of staff and administration, structures that did not need to be would not be, people who did not need to be employed would not be, and meetings that are not necessary would not be held. There would be decisions from discussions, and then implementation after decision. Those who cannot justify a bungling of affairs will be charged with responsibility.

4. The concept of marketplace.

The closure of military industry research institutes for so long has created a weak concept of the marketplace, and fundamental work on market analysis and prediction is also rather weak. We should be watching surveys and analyses of markets, becoming familiar with information and feedback, and should treat markets as the starting and touch points for technology development and development of civilian goods. This is the basis for doing a good job at developing operations.

5. The concept of competition.

With a concept of competition, motivation can be put into place, there will be forecasting and analysis of events, and we will be on top of each fundamental task involved in competition. In the competition for bidding on tasking for military goods and in competition for the development of civilian goods and the technology markets, the pace will be set by the strong.

6. The concept of service.

Maintaining a reputation is foremost. Everything should be in consideration of the customer. Excellent service should be provided, efforts should be made to be constantly opening up new technology markets and to expand areas of service, and more vertical and lateral contracts should be signed to lay the foundation for more economic results.

7. The concept of value.

We must get rid of the effects of the "leftist" influence under which it was held that "the more knowledge there is, the more reactionary it is" and that we should "not respect talent," and should establish concepts of information, talent, and the value of knowledge, which should then be implemented in policy.

8. The concept of strategy.

In the light of strategy, we should be good at the overall picture, and should highly respect operational policies. Having achieved a sense by which attention is paid to the task at hand, where the distant and near are brought together, and where we earnestly carry out and obtain results, this will allow for a long-lasting capacity for competition.

The eight concepts we have just discussed require a firm establishment in leadership at all levels, leadership whose own actions educate and influence all staff and workers.

III. The Keys to the "Three Changes" Are in Adjustment of Cadre Structures and the Development and Training of Talent

Comrade Mao Zedong once said that "After the political line has been determined, cadres are a decisive factor." Premier Zhao has pointed out that "if we are to turn enterprises into enterprises of open models and of operational models, the keys lie in reforming the personnel system of enterprises, in choosing and preparing talent, and in delegating authority. When these are under control, there will be big changes in one-half or in a full year." For these reasons, while holding fast to the line, principles, and policies from the 3d Plenum of the 11th CPC Central Committee, we will meet the demands of the "four modernizations," will reform intently, will continue to advance outstanding young and middle-aged persons to positions of leadership at all levels, so that cadre structures after consolidation will be rational. The resolution of the Central Committee regarding restructuring of the economic system has clearly indicated the mission of adjusting leading groups in the enterprises: it will employ factory directors (managers) who will be able to effectively organize and guide enterprise production and operations. We will be able to enhance greatly technical management within the enterprises and to promote technically advanced senior engineers, who will be able to thoroughly strengthen enterprise operations. Senior economists who can improve results will be able to strictly safeguard financial discipline, and by careful calculation and careful budgeting, senior accountants who can open up financial resources can keep to a correct political direction. And there will be party secretaries who can unite the many staff and workers throughout the enterprises. Although in terms of management research institutes differ from enterprises, in wanting to change toward the direction of "research and production operational development models," we will need to select cadres in accordance with the cadre structures of the enterprises. Based on the current situation, we ought especially to require that institute directors have the guidance capacity for research and production and for decision making in autonomous operations, that they have the capacity for

making research institutes shift in the direction of openness and modern management. We also want talent in the areas of accounting or economics to assist institute directors in controlling operational management, carefully calculating and budgeting, opening financial resources, and improving results.

Economic invigoration will depend upon science and technology, and the invigoration and development of the institutes will be just the same. But science and technology does not descend from Heaven, but rather is controlled by people. Therefore, in the final analysis all depends upon whether or not there is talent. For example, during the last half of 1984 we undertook development of digital instantaneous goniometer (DBD) equipment. This equipment is characterized by a broad bandwidth, quick determination of direction, and high precision, but is very difficult. The key technology is the Butler transmission network. Engineers and technicians responsible for this task integrated the characteristics of the technology and techniques of the institute in question on the basis of foreign technical materials on DBD. They courageously undertook a major design simplification of the Butler network in the DBD and made a significant breakthrough. In only 5 months time they had successfully developed digital instantaneous goniometric equipment with Chinese characteristics. After technical appraisal by higher level organizations, it was held that this equipment fit the design requirements in every aspect, filled a domestic void in this area, and achieved standards equivalent to similar foreign products of the early 1980's. This serves to show that without talent there cannot be this high standard and high speed. Therefore, not only do we want to encourage the positive function and potential of existing talent, but we want also to pay close attention to the training of college students and vocational school students who graduate and are employed each year. We want to develop and train talent through every channel (for example, television courses, short term training, and encouraging self study) so that there will be those who follow. We not only want science and technology talent in large numbers, but also talent that is of high quality and able to manage operations.

There is no question but that with reasonable cadre structures and various kinds of talent, we will be able to overcome the difficulties in our path, will victoriously accomplish the reform, and will realize the task of the "three changes."

IV. Changes in Organization Management Structures Are the Organizational Basis for Realizing the "Three Changes"

Former organizational management structures have been determined by science and technology management systems from the past, and they are already unsuited to the needs of science and technology system reform. We must reform and establish organization management structures complementary to realizing the "three changes." This reform should respect the following principles.

1. It should benefit thorough implementation of the principle of "preserving the military while shifting toward the civilian, and integrating the military and civilian." Under the premise of safeguarding completion of military industry research and production tasking, it must strongly develop civilian goods and technology markets.

2. It should achieve the goals of streamlining, unification, and efficacy, effectively guaranteeing the command authority of the institute director for decision making, that decision making is quick, and that direction is effective. To this end, organizations must streamline and personnel must be capable; organizations should be systematic, there should be hierarchies for decision making, management, and execution, divisions of labor should be clear, and responsibilities apparent; organizations must be in matrix form, where the institute director carries out a vertical leadership of functioning departments through the deputy director, the senior engineers, and the senior accountants; it is best to provide for a deputy director of planning and operations to assist the institute director in operations management, and to enhance lateral coordination.

3. Enhance management organizations that control research and production costs and other management expenses. The goal is for strict control of expenditures, for better budgeting of project funds, for doing a statistical analysis of all investment benefits, for timely provision of materials to leaders, and to achieve low costs, low expenditures, and high results.

4. Strengthen the operations management structures for the development of technology markets. Detail comrades to these structures who know how to operate and can open things up, so that there will be a new aspect as quickly as possible.

5. Strengthen democratic management among staff and workers. Through this step, there will be a constant stimulation for staff and workers to have a feeling of responsibility for their own lives.

V. The Central Link To Realizing the "Three Changes" Is a Strong Focus on Management

For fundamental building toward an emphasis on management, by gathering and doing statistical work on various data, there can then be a comparative, analytical, and scientific review of experiences, and a search for rules and laws that will allow management to continually improve and intensify. Below, we discuss some of the major management work.

1. Planning management.

This has the leading position in all of management work, where each management task is concerned with planning and develops from it. The key to planning management is first of all to investigate and clarify conditions relevant to the drafting and formulation of plans in order to carry out planning forecasting. And it is in the rather scientific, comprehensive, and even final draft, the production of the networking flowcharts, after which organizational implementation and coordination and the solving of problems that arise during implementation will allow things to run efficiently. It is necessary to choose comrades of high quality and abundant experience to be responsible for planning management. It is necessary for all relevant personnel to obey the directions of planning management personnel, and to accomplish missions as much as possible according to networking flowcharts; it is necessary that planning management personnel gather their energies to

accomplish planning management, to study the problems therein, to constantly review and improve, and to become effective managers who are proficient in their professional work.

2. Technology management.

This is an important guarantee for realizing planning management, and is the basis for obtaining technical and economic results. On the one hand, pay close attention to technology development planning, including it in the annual implementation of planning; second, pay close attention to the regular technical management of each research trial production project, as for example: pay close attention to the implementation and execution of sequences in research, program verification, special studies, and key problems in technology and technical appraisals, in an attempt to avoid a great deal of repetition. To do a good job of technical management, not only must relevant personnel in technical commands (as for example, full and assistant senior engineers, directors of laboratories, and technology management departments) take direct responsibility, but technical personnel who take on research tasking projects must also be duty-bound. Diligent implementation of research work schedules is the key to avoiding major problems in daily technology management, and managers must work strictly in accordance with the stages outlined by the schedules and be strict about checks. After meeting the needs of primary goals, the next stage can be entered. To reach a stage without confusion or excess development will also accomplish stage transitions in a timely manner.

3. Quality management.

Without quality, there is no quantity and planning progress, nor are there customers and results, and there can even be a loss of reputation. Seek invigoration through technology, seek existence through quality, and since it is the same for industrial enterprises, how could institutes be any exception in the future. For this reason, we must have quality control to guarantee quality.

4. Management of standardization.

This is a fundamental task for technology that should be actively disseminated and applied. When there is a high degree of standardization, this has a great affect on speeding up the progress of research and production planning, on improving quality, on lowering expenditures, and on improving economic results.

5. Management of material goods.

This has a direct affect on the two important problems of completion of research and production planning and the extent of technical and economic results. Aside from timely provision of the material goods needed by research and production, there must also be a strengthening of management, implementation of cost controls, prohibition of waste, and a filling in of loopholes. For the latter, the following measures may be adopted: first, implement a system that relies upon coupons for redemption. The coupon will

provide for a limited outlay, so first determine the amount of annual outlay for a project, then divide that up according to the total, for each machine, and for each component, and give them to the persons in charge of that task. The amount of outlay will be written clearly on the coupon. Application is necessary before it can be redeemed for an amount in excess of the limit, and the planning department must agree after investigation before additional outlay may be added. Otherwise, those in charge of the warehouses have the authority to refuse redemption. This can both guard against the occurrence of the phenomenon of someone taking another's place and also aids in accounting; second, implement a system with limited allocation of materials, with rewards for economy. For example, restricted standards for issuance of provisions can be formulated for research goods and materials according to the three different categories of basic research, model advanced development, and production projects, or based on different components or raw materials, or according to different proportions. Savings within the restricted range will be rewarded (determining a reasonable proportion for rewards), with no reward and an investigation if the limit is exceeded. And it can also be based on the rate of use on the machine in accordance with the three different items just mentioned (the ratio of that used on the machine to the actual number redeemed). There will be rewards for a certain percentage over the quantity actually used, with an investigation and no reward if the savings is less than the actual use rate. This method will generate a positive effect, the key being to determine the standard limiting the use of materials. The difficulty here and amount of work is rather great, but after diligent practice, attention to statistical analysis, a review of experiences, and with increasing perfection, reasonable standards for limits can certainly be drawn up.

6. Financial management.

The focus here is in careful financial supervision, safeguarding financial discipline, doing a good job at budgeting for project expenses, and analysis of technical and economic results, as well as investment management and results analysis in other areas. Actively comply with measures and methods proposed by relevant departments to improve technical and economic results, which should be implemented after approval by the institute director.

VI. To Promote Goal Management and Establish a Technical and Economic Responsibility System that Integrates Responsibility, Authority, and Profit with Responsibility At Its Core Is To Implement the Important Measures of the "Three Changes"

So called "goal management" is just a management process that sets up methods by which to arrange work, making it easier to realize a specified goal (or condition) within a specified time. It is a method by which to organize institute activities, and is also a method for planning and controlling actual achievements. How military industry institutes are to undertake goal management is a new topic, on which I offer some superficial ideas and methods below.

1. Determine goals.

In practicing goal management, the first thing to do is to determine goals, in which are included the following matters: 1. research and production operations development planning; 2. the quantities and technical standards of scientific and technical achievements, and requirements for dissemination and application; 3. economic results and per capita income; 4. within the allowable limits of national policy, the goal of perfecting and improving material and cultural living standards for staff and workers. Generally speaking, it is best to draw up the objectives for a total of 3 (or 5) years. Under overall goals, also draw up the objectives for each year.

2. Take care of internal contracts.

Fully motivate the enthusiasm of all personnel through the use of contracts, the methods for which are: 1. divide up each year's objectives, clarify quotas, and implement hierarchical contracts. The contractual method is determined according to actual conditions in the particular institute, as for example, undertaking vertical (topic) contracts or lateral (with laboratory or workshop as the unit) contracts, or a method by which vertical and lateral contracts are integrated, after which topics or units contract with individuals; 2. set up and complete technical and economic responsibility systems within the contracts, and expand the authority of contractors (units) to aid completion of contract responsibilities; 3. because completion of contract responsibilities requires guarantees from relevant departments, a warranty system should be established that is integrated with contract responsibilities, so that the circle is complete; 4. strict check-ups, make good on rewards and punishments. There should be specific accounting methods, rewards and punishments should be closely tied to amount of responsibility, degree of tasking, degree of difficulty, technical standards, nature of quality, and degree of efficiency, and the files should be open. There should be no accommodation or taking care of friends, and even less should persons in charge be relatives or parts of cliques.

To urge the development of the contract system, no rewards should be allowed for those who have not contracted for responsibility; for those who have not contracted for responsibility over a long period, basic wages should be reduced (with consideration for length of service); if this involves personnel in a contract system, they should leave their job after fulfillment of the contract period. It should be pointed out that this is work that is extremely policy oriented and may not be ignored. When a contract responsibility cannot be met due to illness because of overwork or weakness due to age, it will be appropriate to either reduce or not the basic wage.

3. Problems that should be noted.

The goals that are determined should be greater than actual capabilities so as to arouse enthusiasm, but they must be such that they can be achieved through effort. This makes an even greater demand upon planning management and those involved in that work. The goals of each unit, each topic, and each individual should be extremely clear. There can be no misunderstandings, for otherwise goal management cannot be smoothly carried out. Technical

developments change all the time, and the goals that are determined should keep up with changes. Appropriate adjustments are permitted, but these may not be blindly done. Each managing department should be strict in checking on things, and should as well help lower levels and individuals to realize their goals, and complete their contract responsibilities.

12586

CSO: 4008/68

NATIONAL DEVELOPMENTS

BRIEFS

CONFERENCE ON TECHNOLOGY MARKETS--To better implement the "Resolution by the CPC Central Committee Regarding Restructuring of the Science and Technology System," and to promote the healthy development of technology markets, with the permission of the State Council the National Technology Market Coordinating Leading Small Group resolved to convene a national technology market working conference in Beijing from 14-18 March. This conference has been called as technology markets are springing up abruptly throughout the country, and is the first large meeting on a national scale since we opened up the technology markets. More than 300 representatives from all ministries and commissions of the State Council, leaders from all provinces, municipalities, and autonomous regions, and from various sectors of science and technology, economics, planning, education, finance, banking, tax revenue, personnel, and legislation will participate in the conference. Carrying out the principles of "relaxing controls, invigoration, support, and guidance," the conference will review and exchange the experiences of various regions and sectors regarding the opening of technology markets; it will further study the problems that need resolution regarding the promotion of healthy development of the technology markets; it will discuss and formulate relevant rules for the technology markets, all in order to continue developing a new look for the technology markets. [Text] [Tianjin JISHU SHICHANG BAO in Chinese 11 Mar 86 p 1] 12586

CSO: 4008/2099

APPLIED SCIENCES

SIMULATION STUDY OF COMBUSTION MECHANISM OF ALUMINUM IN SOLID ROCKET PROPELLANT AT HIGH TEMPERATURES AND PRESSURES IN A SHOCK TUBE

Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese Vol 6, No 3, Aug 85 pp 284-286

[Article by Liu Zichao [0491 1311 6389]]

[Text] I. Introduction

The study of aluminum combustion in pure oxygen or in a $N_2-H_2-Cl_2-O_2$ gas mixture under high temperatures and high pressures (as high as $5000^\circ K$ and 40 atmospheres) in a shock tube can provide simulated conditions for studying the combustion mechanism of aluminum in solid rocket propellant. In this study, calculations of equilibrium constituents under different combustion conditions are carried out to predict possible intermediate and final products of combustion. The emission spectra of certain important intermediate products are identified using a spectrometer and time histories of the AlO emission band are recorded. Detection of the continuous spectrum of Al_2O_2 indicates that AlO is a precursor to Al_2O_2 in the reaction process. The solid and liquid products as well as condensed particles are observed and analyzed using electron diffraction, x-ray diffraction, transmission techniques and scanning electron microscopes. Gaseous products are analyzed using infrared spectrometry. The measurements are in good agreement with computed results and provide useful chemical kinetic data.

It is known that the performance of solid rocket propellant can be significantly improved by adding aluminum. Over the years, many studies have been conducted on this subject, but the problem of chemical kinetics is not well understood. Most studies of aluminum-oxygen reactions have been conducted below 10 atmospheres; essentially no data exists above 10 atmospheres, neither are there any data on aluminum reactions in ammonia perchlorate. As a consequence, predicting the performance of rocket engines is very difficult. For example, because the condensation mechanism of Al_2O_2 particles is still not well understood, it is difficult to predict the effect of the resulting two-phase flow.

The high-temperature, high-pressure region behind a reflected shock wave in a chemical shock tube can simulate the conditions in a rocket engine. Fig. 1 shows the schematic diagram of the aluminum reaction region behind the reflected shock wave in a shock tube. The combustion process and the emission

spectra of intermediate products are recorded using high-speed cameras and spectrometers. The experimental results show that aluminum ignites when the temperature T_5 is between 2000° K and 2400° K, and emits the blue-green light of AlO. This ignition temperature correlates with the melting point of 2300° K of the oxidized layer. By carrying out calculations of the chemical equilibrium constituents, it is possible to predict the intermediate and final products of an Al-O₂ or an Al-N₂-H₂-Cl₂-O₂ reaction and use it as a guide for the experiment. The intermediate and final products can be analyzed using spectral techniques, electron and x-ray diffraction techniques, electron microscopes and infrared spectrometry techniques. The results provide useful chemical kinetic data.

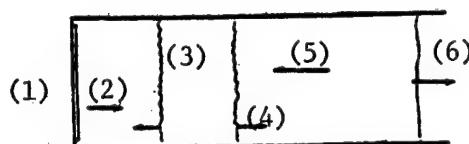


Fig. 1. Schematic Diagram Showing Reaction Region in Vicinity of Aluminum Behind Reflected Shock Wave

- | | | |
|------|--------------------------|-------------------------|
| Key: | 1. aluminum foil | 4. final products |
| | 2. aluminum vapor | 5. working gas |
| | 3. intermediate products | 6. reflected shock wave |

II. Calculated Results of Intermediate and Final Products From Aluminum Combustion

First, the state of the working gas before combustion (pure oxygen or a mixture of 0.1N₂+0.4H₂+0.1Cl₂+0.4O₂) is calculated. Then the intermediate and final products of aluminum combustion under such high temperature and high pressure conditions are calculated. The calculation is based on the method of minimizing the Gibbs free energy under constant pressure and constant enthalpy; it also takes into account real gas effects.

For the Al-O₂ reaction, calculations show that when the Mach number of the incident shock wave is $M_s=9.1$, the state of oxygen before ignition is: $P_s=28.9$ atmospheres, $T_s=4418^\circ$ K, and the composition is: 43 percent of mol fraction oxygen atoms and 56 percent oxygen molecules. The weight ratio between oxygen and aluminum is 1.32, and the aluminum is preheated to a temperature of 900° K. The calculation takes into consideration the possible formation of 23 different constituents during combustion. The temperature after combustion is 4930° K. The intermediate products with the largest proportions are: O (42%) and AlO (19.7%); other products include: Al, Al⁺, AlO⁺, AlO⁻, Al₂O, Al₂O₂, Al₂O₃, and O⁻.

For the Al-($0.1\text{N}_2+0.4\text{H}_2+0.1\text{Cl}_2+0.4\text{O}_2$) reaction, the weight ratio between the gas mixture and aluminum is 2.6, and the composition, the ratio of specific heats, and molecular weight of the gas mixture before combustion are calculated for different values of M_s , T_5 and P_5 . The maximum Mach number, temperature and pressure of the experiment are $M_s=10.5$, $T_5=5150^\circ \text{K}$, $P_5=40$ atmospheres. Under the typical condition of $M_s=7.8$, $T_5=4149^\circ \text{K}$, and $P_5=14.3$ atmospheres, the main constituents before combustion are: O (17%), OH (14.3%), H (13.4%), O_2 (11.4%), H_2O (10.4%), Cl (9.8%), HCl (7%), plus N_2 , H_2 , and NO. The combustion process may produce 80 different constituents; Fig. 2 shows the calculated results of 23 constituents. The constituents with the largest proportions are: Al, AlO, AlCl, HCl, H, O, OH, and Cl. The molecular weight of the combustible gas is 25.67 gm/mol, and its ratio of specific heats is 1.118. Fig. 3 shows the changes of 18 intermediate products during the cooling process. The final products are primarily water, water vapor, HCl, ammonia, N_2 and H_2 as well as Al_2O_3 . This result is in agreement with the measured results of rocket experiments.

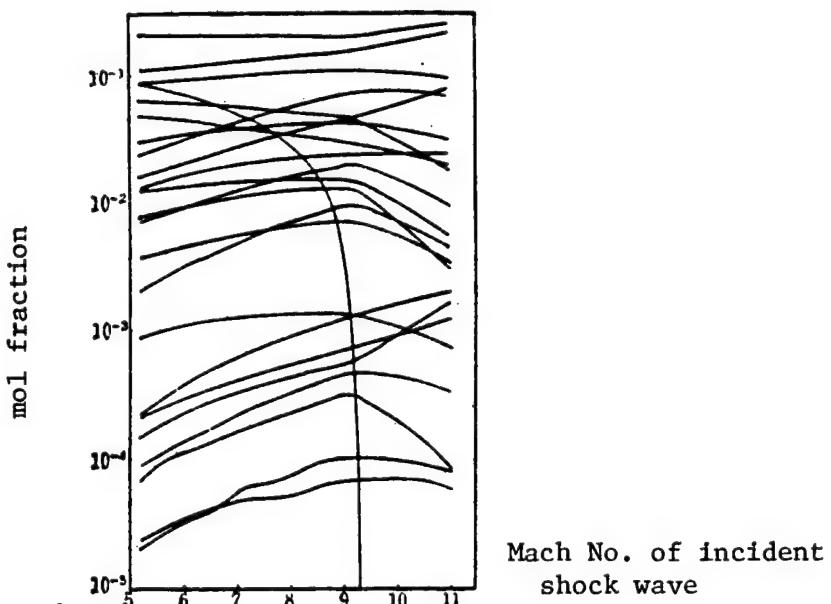


Fig. 2. Calculated Results of the Constituents in an Aluminum-Gas Mixture Reaction. From upper left to right, they are respectively: H, O, OH, Al_2O_3 , H_2O , HCl, AlCl, AlO, Al, NO, AlOCl, AlO_2H , AlO_2 , AlOH, Al_2^0 , AlCl_2 , AlH, Al^+ , N, AlO_2^- , Al_2O_2 , HA10, AlOH^+ .

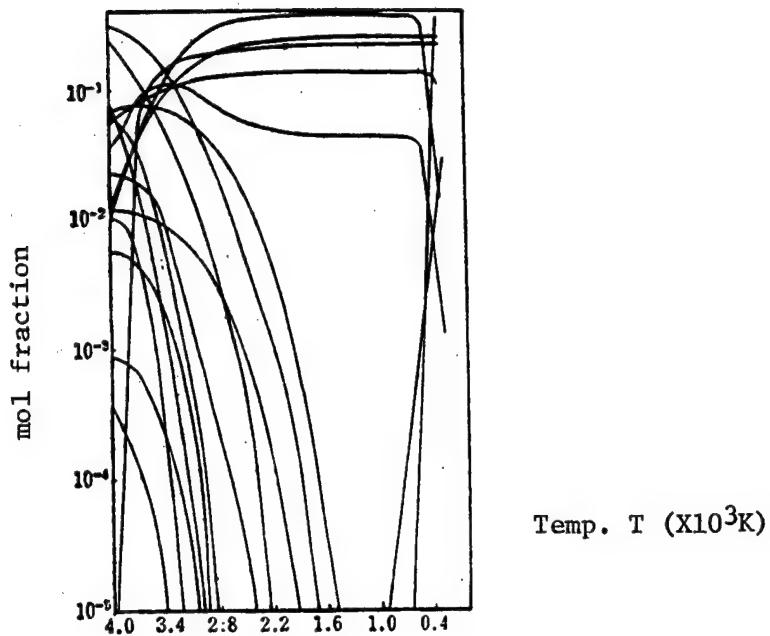


Fig. 3. Changes of the Constituents During the Cooling Process after an Aluminum-Gas Mixture Reaction. From left to right, they are respectively: H, O, Al, Cl, AlOH, N₂, H₂, AlCl₂, HCl, NO, H₂O (vapor), Al₂O, AlO₂, Al₂O₂, AlH, Al₂O₃ (liquid, solid), H₂O (liquid), NH₃.

III. Measured Data of Intermediate and Final Products of Aluminum Combustion

The AL spectral line (3944, 3961.5 Å), the Al⁺ line (5861 Å) and the 6 bands of AlO (4373, 4470.5, 4648.2, 4842.3, 5059.3, 5226.9 Å) have been recorded using a spectrometer. Within the visible-light region, no spectral band of AlO₂, Al₂O or Al₂O₂ is detected, but the AlO band is very pronounced. In the Al-N₂-H₂-Cl₂-O₂ reaction, large numbers of overlapping spectral lines and bands are emitted, but the spectra of Al, Al⁺, AlO, AlH, H and O can still be identified. The weaker bands probably correspond to AlCl, AlCl₂, and AlOH. The time history of the AlO band (see Fig. 4) shows that the peak intensity occurs at 1.4 msec after ignition, and it attenuates after 2 msec; this is followed by a strong continuous spectrum which lasts for 14 msec. Analysis shows that this is part of the Al₂O₂ reaction, and that AlO may well be a precursor to Al₂O₂.

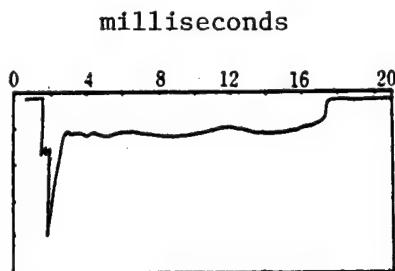


Fig. 4. History of the 4846.2 Å Spectral Intensity of AlO

The white powder produced by the Al-O₂ reaction has been identified to be Al₂O₃ using x-ray diffraction techniques. The spherical particles as measured by the electron microscope range in size from 0.1 to 0.6 microns, which are consistent with the sizes of Al₂O₃ particles in the exhaust plume of rockets. The solid products from the Aluminum-gas mixture reaction have been identified to be condensed Al₂O₃ particulates suspended in a liquid of HCl+H₂O; they are no longer spherical. It is evident that particle condensation is a result of reactions with HCl and H₂O.

The gaseous products from the aluminum-gas mixture reaction have been identified using infrared spectrometry to be water vapor and HCl vapor, which is in agreement with calculations. The large amount of measured NO and NO₂ which greatly exceed the calculated amount is caused by the non-equilibrium cooling process.

IV. Conclusion

1. The region behind a reflected shock wave in a chemical reaction shock tube can provide simulated conditions for studying the combustion mechanism of aluminum in solid rocket engines.
2. The calculated intermediate and final products after combustion are basically in agreement with measured results. This provides useful data for studying the combustion mechanism of aluminum under high temperature and high pressure conditions.

3012/12859
CSO: 4008/59

STUDIES OF THE COLOR REACTION OF QUATERNARY COMPLEX ALUMINUM-FLUORINE-XYLENOL ORANGE-CETYL PYRIDINE BROMIDE

Changchun FENXI HUAXUE [ANALYTICAL CHEMISTRY] in Chinese Vol 13 No 12,
20 Dec 85 pp 881-886

[English abstract of article by Ren Ying [0117 5391], et al., of Changchun Institute of Applied Chemistry, Chinese Academy of Sciences]

[Text] In neutral solution a quaternary complex of aluminum can be formed in red with NaF, xlenol orange (XO) and cetylpyridine bromide. This complex exhibits maximum absorption at 520 nm with an apparent molar absorption coefficient of 1.6×10^4 . This complex is so stable that a large amount of DTPA does not interfere with the determination of Al. In the presence of DTPA there is no interference by large amounts of Fe^{3+} and a number of other diverse ions. Therefore, a method is developed for determining aluminum in nickel-chromium-iron alloy, zinc-cast aluminum alloy and copper-cast aluminum alloy with satisfactory results. The procedure is simple and rapid. (Paper received 6 September 1984.

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APPLICATION OF PC-1500 COMPUTER TO IMPROVED STANDARD ADDITION METHOD

Changchun FENXI HUAXUE [ANALYTICAL CHEMISTRY] in Chinese Vol 13 No 12,
20 Dec 85 pp 903-908

[English abstract of article by Li Yuxiu [2621 3768 4423], et al., of the
Department of Chemistry, Nankai University]

[Text] A description is given of a procedure for the preparation of a perchlorate-coated electrode, the determination of perchlorate ion concentration by an improved standard addition method and the calculations on a PC-1500 computer. The authors have calculated $C_{\text{ClO}_4^-}$ at $C_{\text{ClO}_4^-} = 1.0 \times 10^{-4}\text{M}$, and $C_{\text{ClO}_3^-} = 1.0 \times 10^{-2}\text{M}$ on a PC-1500 computer and obtained a mean result of $C_{\text{ClO}_4^-} = 1.08 \times 10^{-4}\text{M}$. (Paper received 17 December 1984.)

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DETERMINATION OF MICROAMOUNTS OF VANADIUM (V) IN ORES

Changchun FENXI HUAXUE [ANALYTICAL CHEMISTRY] in Chinese Vol 13 No 12,
20 Dec 85 pp 928-930

[English abstract of article by Duan Qunzhang [3008 5028 4545], et al., of
the Department of Chemistry, Southcentral University of Technology]

[Text] In the buffer solution of $\text{CH}_2\text{ClCOOH-NaAc}$ at pH of 2.0-3.0, V(V)
reacts with 5-Br-PADAP to form a 1:1 complex, which can be dissolved by a
surfactant and has maximum absorption at 590 nm. Its molar absorptivity is
 $9.06 \times 10^4 \text{ l} \cdot \text{mol}^{-1} \cdot \text{cm}^{-1}$. Beer's law is obeyed in the range of 0.2 to 16 $\mu\text{g}/$
25 ml of V. This method has been applied satisfactorily for the determination
of microamounts of V(V) in ores. (Paper received 6 August 1984.)

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9717
CSO: 4009/1049

STUDY OF THE PERFORMANCE AND MECHANISM FOR POLYACRYLAMIDE OXIME-CARBOXYLIC ACID CHELATE FIBER ENRICHING VARIETY OF TRACE ELEMENTS

Changchun FENXI HUAXUE [ANALYTICAL CHEMISTRY] in Chinese Vol 14 No 1,
20 Jan 86 pp 1-8

[English abstract of article by Chang Xijun [1603 1585 0193], et al., of the Chemistry Department, Lanzhou University]

[Text] The polyacrylamide oxime-carboxylic acid chelate fiber was synthesized using polyacrylonitrile fiber as the original material. The conditions for acidity of quantitative enrichment, adsorption rate, desorption acidity, saturated adsorption amount and interfering coexisting ions on 30 kinds of trace elements were investigated. The stability, acid-base tolerance and generative performance of the chelate fiber and enrichment mechanism are discussed. The enrichment of lower concentration as well as the determination of samples have been achieved with satisfactory results. (Paper received 6 August 1984; finalized 6 May 1985.)

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MICRO-DETERMINATION OF YTTERBIUM WITH ELECTROTHERMAL ATOMIC ABSORPTION SPECTROMETRY

Changchun FENXI HUAXUE [ANALYTICAL CHEMISTRY] in Chinese Vol 14 No 1,
20 Jan 86 pp 8-12

[English abstract of article by Chen Depu [7115 1795 2613], et al., of the Institute of Chemistry, Chinese Academy of Sciences]

[Text] This communication reports the use of a pyrolytic graphite coated tube, lined with tantalum-tungsten, and a locally-made atomic absorption spectrometer (Model WFD-Y3) for the determination of trace amounts of Yb in pure Y_2O_3 and mixed rare earth oxides. It is found that the method proposed is sensitive, reproducible and simple to manipulate. Even as low as 0.2 μg Yb in a one-gram sample ($n \times 10^{-7}$) can be determined directly without pre-concentration. It is found experimentally that the optimum condition for drying is at 150°C for 20 sec, ashing at 1000°C for 20 sec and atomization at 2770°C for 12 sec. Within the range of 1.0-18 ng Yb/ml, the calibration curve of Yb is linear. Before injecting it into the tube, the acidity of the sample solution should be adjusted to 0.1 to 2 M with nitric or hydrochloric acid. For 5 ng Yb/ml, Al(III), Ca(II) and La(III) interfere when their amount present is 50 $\mu\text{g}/\text{ml}$ or more. On the other hand, Cu(II), Fe(III), Mg(II), K(I) and Y(III) in amounts of up to 1 mg/ml do not interfere. (Paper received 4 July 1984; finalized 8 June 1985.)

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SIMULTANEOUS SPECTROPHOTOMETRIC DETERMINATION OF TRACE SILICON, PHOSPHORUS AND ARSENIC AS CRYSTAL VIOLET-HETEROPOLY ACIDS IN THE PRESENCE OF NONIONIC SURFACTANT

Changchun FENXI HUAXUE [ANALYTICAL CHEMISTRY] in Chinese Vol 14 No 1,
20 Jan 86 pp 15-21, 46

[English abstract of article by Wang Zhendi [3769 6966 2769] of the Center of Chemical Analysis, Nanjing Institute of Forestry; and Zheng Yongxi [6774 3938 3556] of the Department of Chemistry and Chemical Engineering, Qinghua University]

[Text] A highly sensitive and convenient spectrophotometric method is described for simultaneous determination of Si, P and As, based on the ion-associates formed by heteropoly acids with crystal violet (CV) in the presence of the emulsifying agent OP. The optimum conditions are as follows: $[H^+] = 0.26 N$, $[MoO_4^{2-}] = 1.5 \times 10^{-3} M$, $[CV] = 1.2 \times 10^{-4} M$ and $[OP] = 3.1 \times 10^{-3} M$. The maximum absorbance of the ion-associates (CV-SiMo, CV-PMo, CV-AsMo) is at 555 nm, and the absorbance of the three ion-associates has additive properties. The molar absorptivities of CV-SiMo, CV-PMo and CV-AsMo are 1.45×10^5 , 1.70×10^5 and $1.69 \times 10^5 \text{ l} \cdot \text{mol}^{-1} \cdot \text{cm}^{-1}$ at 555 nm respectively. The proposed method has been applied to the determination of trace amounts of Si, P and As in waters and alloys with satisfactory results. The dependence of the molar ratio of the main components in the ion-associates on the acidity is discussed further. It is found that the spectrophotometric properties and molar absorptivity of the ion-associates are mainly dependent on those of the basic dye cations. (Paper received 29 October 1984.)

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DETERMINATION OF IRON AND MANGANESE IN NATURAL WATERS BY THE 2.5 ORDER DIFFERENTIAL POLAROGRAPHY

Changchun FENXI HUAXUE [ANALYTICAL CHEMISTRY] in Chinese Vol 14 No 1,
20 Jan 86 pp 22-25

[English abstract of article by Lin Wenru [2651 2429 1172], et al., of the Department of Chemistry, Fuzhou University]

[Text] A 2.5th differential polarographic method for determination of Fe and Mn in tap water and thermal spring water has been developed. With a solution of 0.001M KNaC₄H₄O₆-0.01M NH₄Cl-NH₄OH(pH5.5-7.0) as the supporting electrolyte, Fe and Mn give well-defined neopolarograms. The amounts of Fe and Mn are then determined by the standard addition method. It is found that Ca(II), Cd(II), Co(II), Cr(III), Cu(II), Mg(II), Ni(II), Pb(II) and Zn(II) do not interfere with the determination under experimental conditions.
(Paper received 19 December 1984.)

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NEW GRAPHIC METHOD FOR DETERMINING THE COMPOSITION OF COMPLEXES AND FORMATION
CONSTANT BY SPECTROPHOTOMETRY

Changchun FENXI HUAXUE [ANALYTICAL CHEMISTRY] in Chinese Vol 14 No 1,
20 Jan 86 pp 25-30

[English abstract of article by Li Changhua [2621 7022 5478], et al., of
Fujian Research Institute of Metallurgical Industry]

[Text] A new method for determining the real composition of complexes is presented. The method is based on the effect of dilution on the degree of dissociation, but the mathematical treatment is different from the others previously described. The formation constant is assumed to be the function of some independent variables, and an indeterminate equation is set up and solved by the graphic method to obtain the values of m and n for complexes of the type M_mB_n . The formation constant is given as well. The method is applicable to mixed ligand complexes and binary complexes. The results for three well-studied systems, Fe-chromazurol S, Cu-orotic acid and Ni-antracpurpurin, are shown as the demonstrations. (Paper received 29 December 1984.)

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FACTOR ANALYSIS PHOTOMETRY FOR DETERMINING MULTICOMPONENTS OF MIXTURES

Changchun FENXI HUAXUE [ANALYTICAL CHEMISTRY] in Chinese Vol 14 No 1,
20 Jan 86 pp 34-40

[English abstract of article by He Xiwen [0149 6932 2429], et al., of the
Department of Chemistry, Nankai University]

[Text] Factor analysis has been used as a powerful tool for determining the number of components that contribute to the absorption spectra of multi-component systems. The use of such an approach for both qualitative and quantitative analysis of mixtures is described. Rank analysis showed that there were three components present in the mixture (Ni, Cu, Zn). This technique was also applied to data concerning mixtures of four components (Ni, Cu, Zn, Co). We concluded that sample components were present since each component acted as a factor. The nine statistical criteria were employed to reach this conclusion. Each of these criteria requires an exact knowledge of the experimental error. Model data are used to illustrate the behavior of these functions. The method has been applied to problems of interest to chemists involving nuclear magnetic resonance, absorption spectroscopy, mass spectra, etc. (Paper received 30 January 1985.)

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EXTRACTION-ATOMIC ABSORPTION SPECTROMETRIC DETERMINATION OF RUBIDIUM AND CAESIUM IN BRINE

Changchun FENXI HUAXUE [ANALYTICAL CHEMISTRY] in Chinese Vol 14 No 1,
20 Jan 86 pp 55-57

[English abstract of article by Shen Zhentian [3088 2182 1132], et al., of
Qinghai Institute of Saline Lakes, Chinese Academy of Sciences]

[Text] The extraction of Rb and Cs by the substituted phenols, especially 4-t-butyl-2(α -methylbenzyl) phenol (BAMBP) has been studied. The optimum concentration of NaOH and BAMBP for the extraction of Rb and Cs is 1.0 M. If an appropriate amount of sodium tartrate is added as the masking agent before adding the other reagent, the precipitation of Mg or Fe can be prevented. This method has been successfully applied to the quantitative estimation of Rb and Cs in brines with lower detection limits than those of the general method. The relative error is ± 6 percent. The method is rapid, simple and sensitive. (Paper received 8 September 1984.)

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9717
CSO: 4009/1047

PHOTOACOUSTIC SPECTROSCOPY STUDIES OF LATTICE DAMAGE IN Si WAFERS

Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH] in Chinese
Vol 5 No 2, Apr 86 pp 81-87

[English abstract of article by Su Jiuling [5685 0046 0109], et al., of the Department of Physics, Fudan University]

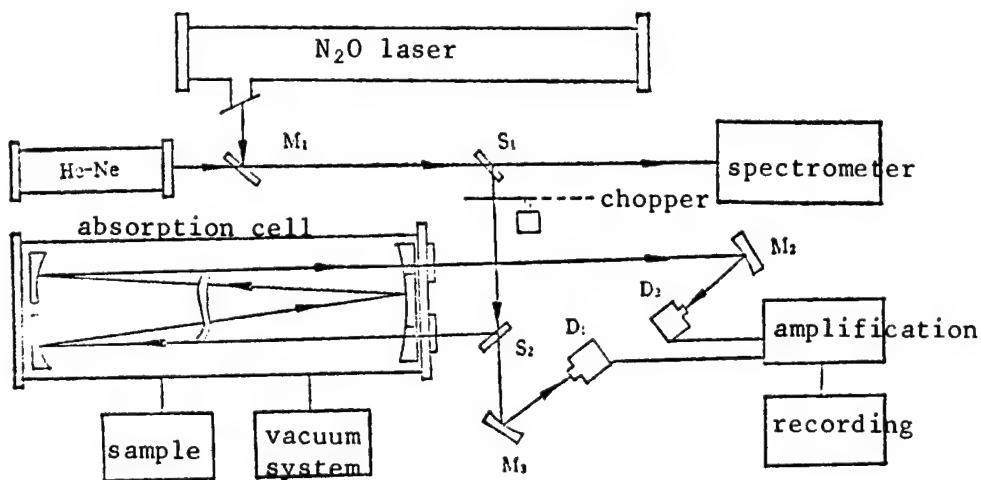
[Text] The effect of boron-implantation on Si wafers and the annealing behavior of ion-implanted Si wafers are studied by photoacoustic spectroscopy (PAS) and the results are reported. The change of the magnitude of lattice damages induced by boron implantation with doses ranging from 10^{12}cm^{-2} to 10^{15}cm^{-2} has been observed. After the annealing, the magnitude of residual defects in the damaged region is compared qualitatively. Comparison between normalized photoacoustic spectra of boron-implanted and phosphorus-implanted silicon wafers and alundum-ground silicon wafers makes it clear that there are some differences between boron-implanted and phosphorus-implanted silicon wafers, and there are similar lattice damages to them under high doses. Comparison between the effects of conventional thermal annealing and rapid thermal annealing comes to the conclusion that the rapid thermal annealing is more effective than the conventional one in removing defects in an ion-implanted layer of Si wafers under certain circumstances. It is seen that PAS is a rapid, sensitive, convenient and nondestructive method for examining the lattice damage in Si wafers and the effectiveness of thermal annealing in the IC process.

PRESSURE SHIFTS OF $10.8 \mu\text{m}$ N_2O MOLECULAR SPECTRAL LINES

Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH] in Chinese
Vol 5 No 2, Apr 86 pp 89-92

[English abstract of article by Guo Zengxin [6753 1073 2946], et al., of the
Department of Physics, East China Normal University]

[Text] The pressure shifts of N_2O molecular absorption spectral lines are observed and measured using a selected-branch N_2O laser and White-type absorption cell. The measurements agree with the QFT theoretical calculations.



Experimental Setup

STUDY OF IR BROAD-BAND PRSA TYPE ELLIPSOMETER

Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH] in Chinese
Vol 5 No 2, Apr 86 pp 99-106

[English abstract of article by Zhang Keqi [1728 0344 1142], et al., of
Shanghai Institute of Technical Physics, Chinese Academy of Sciences]

[Text] The experimental set-up of an IR broad-band PRSA type ellipsometer developed by the authors and its measuring errors are described in detail. In particular, the influence of the limited extinction ratio and additional phase delay of the wire grid polarizers on measurement accuracy is analyzed. The typical results from the measurement of ZnS, ZnSe and PbTe layers are given in order to demonstrate the capabilities of this instrument.

FULLY AUTOMATIC SYSTEM FOR MEASURING I-V CHARACTERISTICS OF INFRARED DETECTOR ARRAYS

Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH] in Chinese
Vol 5 No 2, Apr 86 pp 117-122

[English abstract of article by Chen Zhonggan [7115 0112 3927] of Kunming Institute of Physics]

[Text] This system consists of a HP-85 computer, three instruments made by Keithley Co., i.e., 195 DMM, 220 current source and 705 scanner, and a multifunction measuring system made by the author, with software written for running the system. This is a complete system which can make automatic measurements and has the ability to treat elements with broken connections or abnormal behavior.

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CSO: 4009/71

FLIP-FLOP SENSE AMPLIFIER WITH HIGH SENSITIVITY FOR HMOS-SRAM

Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTORS] in Chinese Vol 7
No 2, Mar 86 pp 121-127

[English abstract of article by Zhang Zhongxuan [1728 6988 1357], et al., of
Qinghua University]

[Text] A new sense amplifier for HMOS-SRAM is described. It is composed of a cross feedback source follower pair and is set at critical flip-flop state by precise control of the ratio of two transistor sizes. It is proved theoretically and experimentally that advantages of this circuit are high sensitivity, large common-mode region and low output common-mode level. When it is used in SRAM, excellent results are obtained. (Paper received 19 March 1985.)

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INVESTIGATION OF BISTABLE CHARACTERISTICS OF SEMICONDUCTOR LASER WITH SINGLE CAVITY AND DOUBLE CONTACTS

Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTORS] in Chinese Vol 7 No 2, Mar 86 pp 136-146

[English abstract of article by Wang Shouwu [3769 1343 2976], et al., of the Institute of Semiconductors, Chinese Academy of Sciences]

[Text] The bistable behavior of a laser with a single cavity and double contacts calculated numerically based on consideration of interband absorption with K selection rule starting from the multimode rate equations is reported. Systematic analysis of various factors which affect the two important parameters of the device (width of the bistable injection region and response time) is also reported. (Paper received 20 May 1985.)

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OPTICAL BISTABILITY AND SWITCHING CHARACTERISTICS OF GaAs/GaAlAs pnpn
NEGATIVE RESISTANCE LASER

Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTORS] in Chinese Vol 7
No 2, Mar 86 pp 147-153

[English abstract of article by Wang Shouwu [3769 1343 2976], et al., of the
Institute of Semiconductors, Chinese Academy of Sciences]

[Text] Reported for the first time are some experimental results regarding
the optical bistability and switching characteristics of a pnpn type GaAs/
GaAlAs laser device. Based on the double phototransistor model, a general
analysis is given of the physical description of the optical bistability and
switching operations in the device. (Paper received 21 May 1985.)

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SHALLOW IMPURITY STATE IN GaAs-Ga_{1-x}Al_xAs SUPERLATTICES

Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTORS] in Chinese Vol 7
No 2, Mar 86 pp 164-173

[English abstract of article by Ma Delu [7456 1795 6922], et al., of the
Department of Physics, Liaoning University]

[Text] Binding energies of the ground state of a shallow impurity in real
GaAs-Ga_{1-x}Al_xAs superlattices with a large number of equal thickness alternating
layers are calculated using a variational approach. In our calculations,
the effects due to different effective masses and dielectric constants in
GaAs and Ga_{1-x}Al_xAs layers and the non-parabolicity of GaAs conduction bands
are included. The binding energy is calculated as a function of layer
thickness and exhibits only one peak as Chaudhuri expected. For very thin
superlattices the binding energy approaches a stable value.

The corresponding quantity in the case of three quantum wells is also
calculated and compared with Chaudhuri's results. It is shown that when
 $x = 0.4$, the correction of the main peak value of binding energy exceeds
16 percent. (Paper received 4 March 1985.)

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COMPUTER REAL TIME CONTROLLED SYSTEM FOR EXPERIMENTAL STUDIES IN SOLID STATE ELECTRONICS

Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTORS] in Chinese Vol 7 No 2, Mar 86 pp 202-208

[English abstract of article by Bai Guang [4101 0342], et al., of the Graduate School, University of Science and Technology of China]

[Text] A fully automatic computer controlled system for experimental studies in solid state electronics is designed and implemented. A HP87 microcomputer is used as a controller, interfacing with intelligent measuring instruments via IEEE 488 interfaces. The system is actually a highly parallel processing system consisting of multiprocessors included in the central controller and intelligent instruments to overcome the low speed disadvantage of the controller. Thus, the system is very powerful and flexible for solid state electronics experiments and is reasonably priced. A highly efficient DLTS measurement is described as an illustration. (Paper received

15 February 1985.)

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STABILITIES OF ROTATIONAL DISCONTINUITY FOR MAGNETOPAUSE

Beijing KONGJIAN KEXUE XUEBAO [CHINESE JOURNAL OF SPACE SCIENCE] in Chinese
Vol 6 No 2, Apr 86 pp 89-96

[English abstract of article by Wang Shui [3769 3055], et al., of the
Department of Earth and Space Sciences, University of Science and Technology
of China]

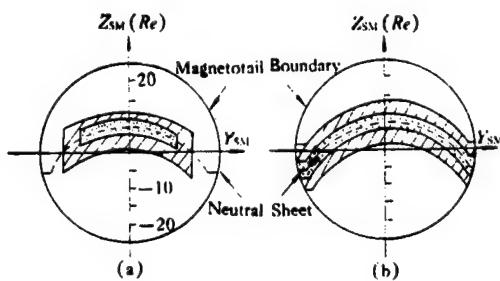
[Text] Using a three-layer model and observations from Satellite ISEE, the
stabilities of rotational discontinuity for magnetopause are discussed. The
results show that: (1) a kind of instability may be excited in the magneto-
pause rotational discontinuity, and the growth rate of the instability
increases as the wave number k increases; (2) when the interplanetary magnetic
field is northward, the magnetopause rotational discontinuity is stable; when
the interplanetary magnetic field becomes southward gradually, the growth rate
of the instability increases rapidly; (3) when the velocity of the solar wind
is larger, the growth rate of instability is correspondingly larger; (4) when
the interplanetary magnetic field is southward, the growth rate of instability
increases rapidly as the angle between the interplanetary magnetic field and
the tangential surface of the magnetopause increases.

SOME STATISTICAL RESULTS OF ENERGETIC PARTICLE PULSES IN MAGNETOTAIL

Beijing KONGJIAN KEXUE XUEBAO [CHINESE JOURNAL OF SPACE SCIENCE] in Chinese
Vol 6 No 2, Apr 86 pp 97-101

[English abstract of article by Wu Jiping [0702 1376 5493] of the Institute of Space Physics, Chinese Academy of Sciences]

[Text] This paper presents the results of correlation analysis between the data of energetic particle pulses obtained by the IMP-J spacecraft (P4: 230 keV > E > 160 keV) and auroral electrojet index AE. The magnetotail is divided into three regions: neutral sheet region, low latitude region and high latitude region. It is found that: (1) In the neutral sheet region, the average energetic particle flux is the highest among all three regions. In the high latitude region the flux is the lowest. This indicates that the "source" of energetic particle pulses may be located in the neutral sheet region. (2) The correlation between energetic particle pulses and the AE index is most significant in the neutral sheet region, with the correlation coefficient R being 0.59. In low and high latitude regions, R decreases sharply. This coincides with the idea that energetic particle pulse event is the substorm relevant event, and that the particles are accelerated by an induced electric field caused by the magnetic field line reconnection near the neutral sheet region. (3) The accelerated area is limited to a thin layer around a neutral sheet, which coincides with Hones' results.



SOME OBSERVATION RESULTS OF RADIATION BELT ELECTRONS FROM SATELLITE-BORNE
SEMICONDUCTOR TELESCOPE

Beijing KONGJIAN KEXUE XUEBAO [CHINESE JOURNAL OF SPACE SCIENCE] in Chinese
Vol 6 No 2, Apr 86 pp 147-151

[English abstract of article by Cheng Dongyuan [4453 2767 0337], et al., of the
Institute of Space Science, Chinese Academy of Sciences]

[Text] By analysis of observation data from instruments on board Chinese satellites, the typical omnidirectional fluxes of inner belt electrons with energy higher than 0.5 MeV and 1.0 MeV as 1.9×10^8 and 6.7×10^7 ele/s·cm² respectively are obtained. A profile of electron flux on a typical orbit is also given. In addition, the omnidirectional fluxes with the same energy ranges at the synchronous altitude obtained from the first Chinese geostationary satellite are 2.43×10^6 and 4.25×10^5 ele/s·cm² respectively. At the same time, the diurnal variations of electron flux of the outer radiation belt are also given and they are essentially agreeable with the observations made abroad.

DESIGN AND CONSTRUCTION OF HIGH PRECISION PRISM SUN SENSOR

Beijing KONGJIAN KEXUE XUEBAO [CHINESE JOURNAL OF SPACE SCIENCE] in Chinese
Vol 6 No 2, Apr 86 pp 152-157

[English abstract of article by Xiao Gongbi [5135 0501 1732], et al., of the
Institute of Automation, Chinese Academy of Sciences]

[Text] In carrying out a project developing an astronomical satellite, a prototype of a high precision prism sun sensor was designed and constructed. The principle of prism solar position measurement is proposed. Using this principle and such methods as energy balance measurement, compensation of the variation of irradiance, etc., a high precision measurement of solar position is realizable. A sun sensor designed with this principle has high resolution and precision in small view fields, small size, light weight and long service life. According to the conclusion of a formal evaluation, such an instrument has a resolution of 1" and a precision of $\pm 3''$ in a view field of $\pm 70'$. The entire system weighs 2.5 kg and requires 1 watt of power consumption.

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18 July 1986

Urbanization

PROVINCIAL VARIATION OF URBANIZATION IN CHINA

Beijing DILI XUEBAO (ACTA GEOGRAPHICA SINICA) in Chinese Vol 41, No 1,
Mar 86 pp 8-21

[English abstract of article by Xu Xueqiang of Zhongshan University and
Gar-on Yeh of Hong Kong University]

[Text] China's cities belong to the clustered pattern, examining them by Kolmogorov-Aminov formula and the Lorenz curve. The highest density of cities and towns has happened in Shanghai municipality: 56.77 cities and towns per 10,000 km². Zhejiang and Jiangsu Provinces occupy second and third places, according to the density of urban settlements: 17.06 and 11.67 cities and towns per 10,000 km² respectively. The lowest density indexes of cities and towns are found in Xizang Autonomous Region and Qinghai: 0.08 and 0.12 respectively. The density of cities and towns is regularly reducing from East to West in China. The provincial variation of the density of cities and towns can be explained by the regression techniques. A correlation coefficient of 0.87 has been obtained by the regression analysis of the density of cities and towns, in which the population density as independent variable. In provinces and autonomous regions, the greater the population density, the greater the density of cities and towns. A multiple correlation coefficient is 0.96, which was found by multiple regression analysis of the density of urban settlements with the gross industrial and agricultural output value, per capita industrial output, the index of the railway length, per rural person grain output, and population density as independent variables. These five variables can explain 92 percent of the provincial variation of the density of urban settlements.

Because the urbanization is measured by the proportion of urban population to the provincial total ones, the urbanization level of those provinces with concentration of urban settlements and urban population seems to be not so high. Most of the relatively high urbanized provinces and autonomous regions are located in Northeast, North and Northwest China, while the provinces with moderate and lower urbanization level are found in the East, Central and South provinces. Variables of population density, size of area, and industrial-agricultural output ratio, per capita industrial output, per capita agricultural output, per capita total production output can be used for reflection of provinces' population and economic characteristics respectively. Two factors are identified by factor analysis with varimax

rotation. The first factor is industrialization that measures the levels of industrialization and productivity and the second factor is population density that reflects the general population distribution characteristics of a province or an autonomous region. As these two factors are orthogonal to each other, it suggests that there is no direct relationship between the industrialization level with population size or density in every province or autonomous region. A multiple correlation coefficient of 0.863 has been obtained by multiple regression analysis between urbanization level with the factor scores of industrialization level and population density as independent variables. These two factors could explain 74.5 percent of the provincial variation of urbanization level. The urbanization level of a province or an autonomous region is related positively with industrialization level but negatively with population density. The industrial distribution policy encourages urbanization for the less densely populated Northeast, North and Northwest provinces and autonomous regions. To a certain extent, the control of urban population discourages urbanization for the densely populated East.

There is big variation in the primacy index of the provinces in China. It ranges from 1,009 in Anhui to 10.23 in Qinghai (in 1982). The provinces and autonomous regions with high primacy index are mainly concentrated in the Northwest and Southwest regions of China, except Guangdong and Hubei Provinces. The indexes of provinces and autonomous regions in West China have increased since liberation, but in recent years, they have begun to fall in some provinces and autonomous regions. Most of the Northeast, East, North, and Central South provinces have moderate or low primacy indexes, which have declined since liberation. The provincial variation of the urban primacy index may be explained by the urban development history, the development potential of the primacy city in provinces, the national industrial distribution policy and different stages of the economic development of provinces and autonomous regions.

In recent years, due to practising the open policy to the outside world the policy permitting peasants to go into towns to do businesses on the basis of self food supply and other policies as well, the urbanization process has been speeded up, urban primacy index has been relatively raised in some provinces and autonomous regions, and the development of small towns has been greatly made.

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